
Final Report

Overview History of New Jersey Highway Development

Prepared for: State of New Jersey Department of Transportation
Bureau of Environmental Analysis

Prepared by: KFS Cultural Resources Group
Kise Franks & Straw, Philadelphia, Pennsylvania

July 1997

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TABLE OF CONTENTS

Introduction	1
Early Roads and Turnpikes (1673-1889).....	2
Road Use.....	2
Road Legislation and Financing	16
Road Construction	21
Good Roads Era (1890-1904).....	27
Road Use.....	27
Road Legislation and Financing	31
Road Construction	34
Advent of the Automobile Era (1904-1917).....	38
Road Use.....	38
Road Legislation and Financing	43
Road Construction	49
Towards A Unified Highway System (1917-1946).....	54
Road Use.....	54
Road Legislation and Financing	65
Road Construction	73
Conclusion	91
Bibliography	95

OVERVIEW HISTORY OF NEW JERSEY HIGHWAY DEVELOPMENT

Introduction

In the three centuries following the 1673 passage of New Jersey's first public road act, the state's road system developed to meet a host of transportation demands.¹ These ranged from the most fundamental goal of providing passage for goods to market, to the more particular requirements of rural postal delivery and military defense.² Due to New Jersey's geographical position between New York and Philadelphia, the state emerged as a natural conduit for regional traffic. In the nineteenth century, long-distance turnpike routes traversed the central part of the state connecting these two major commercial centers. Shorter radial toll roads originating from population centers like Camden, Trenton, and Newark, and a decentralized system of poorly-maintained township roads supplemented the relatively few long-distance routes.

Road construction waned during the latter half of the nineteenth century, due to increasing competition from railroads and canals. Technological advancements in road-building machinery and materials, however, allowed local road commissions to address increasing demands for passable routes made by farmers and cyclists in the 1890s. The introduction of state and federal funds for road improvements and the establishment of the New Jersey Highway Department helped centralize road construction activity in the state and spurred long-awaited improvements. During the 1920s and 1930s, increasing flexibility and reliability allowed improved roadways to rival the previously dominant railroad and canal systems as the preferred method of transporting passengers and freight. Intense commercial and residential development followed the growth of the highway system during the first half of the twentieth century and amplified the impact of road construction on the existing landscape. Proper planning and design took on paramount importance by the 1950s, as New Jersey faced an explosive increase in traffic volume that was exacerbated by a substantial construction backlog resulting from the Depression and World War II.

In order to understand the evolution of road and highway development in New Jersey, as well as the relationship between individual routes and their associated built environment, one must recognize the factors that historically influenced the execution of new construction

¹New Jersey State Highway Department Bureau of Public Information. *Development of the New Jersey State Highway System* (N.p., 1956), 2.

²*Ibid.*, 2.

and improvements. In the nineteenth century, the primary motivator for road construction was an unmet transportation need expressed by an influential constituency. By the 1920s, however, highway departments used scientific traffic surveys to determine and evaluate transportation needs. Once a need was ascertained, the next step involved obtaining project approval through the proper administrative channels. Approved proposals then became eligible for funding, the sources of which varied over time. Levels of funding, sophistication of construction equipment and methods, and contemporary approaches to design all affected the final product. The product of those endeavors consisted of not only the roadbed, but of all the roadway features within the right-of-way.

The goal of this study is to provide a broad framework that presents the major themes in New Jersey highway development and facilitates the evaluation of the historic significance of these structures and their associated features. This report is not intended to be a definitive study of New Jersey's highways, but rather a foundation for analyzing individual routes and placing them into a statewide context. The report is divided into four sections: Early Roads and Turnpikes (1673-1889), The Good Roads Era (1890-1904), The Advent of the Automobile (1904-1917), and Towards A Unified Highway System (1918-1946). Within each section the following issues are addressed: What were the prevailing road types of the era? Who were the primary road users and how were the roads utilized? Who was responsible for building and maintaining these roads and what were the funding sources? and What were the dominant characteristics of the roadways with regard to: materials, design guidelines, and associated roadway and roadside features?

Early Roads and Turnpikes (1673-1889)

Road Use

New Jersey's first European settlers were drawn to the state's numerous coastal streams and rivers. The initial wave of colonists selected choice properties along navigable waterways where they had ready access to water transportation. Once these waterfront parcels had been taken, later arrivals were compelled to move further inland to stake their claims. Paths created by Native Americans provided routes to these interior regions. Pioneers adopted these trails and gradually improved some of the major routes. Adapting pre-existing trails proved much easier than creating new, uncharted routes; however, colonists still preferred water transportation. These trails shaped the development of street patterns in some of the state's early settlements, like Elizabeth, where their influence may

still be seen.³ The colonists concentrated on improving their land during this first century of settlement. Road construction was not a priority, and most residents were content to use established overland and water routes well into the eighteenth century. According to turnpike historian Joseph Durrenberger, "Few roads of more than local significance existed prior to the eighteenth century and conditions improved very slowly during the remainder of the colonial period."⁴ Between 1755 and the close of the Revolution, military conflicts with the French, Native Americans, and British monopolized surplus materials, funding, and energy in the colonies, leaving limited time and resources for the construction of internal improvements such as roads.⁵

A few inter-regional routes did, however, exist. The colonial government provided occasional funding for the upkeep of these roads, which were designated Kings Highways. Three Kings Highways connected New York and Philadelphia during the eighteenth century. These included Lawries Road, which connected Perth Amboy and the "Delaware District;" the Old Dutch Road, which linked Elizabeth-Town with New Brunswick, Princeton, and Trenton; and the Old York Road, which ran north of Trenton, through Ringoes to Bound Brook on the north branch of the Raritan where it divided, with one route going to Elizabethtown and the other to Perth Amboy via New Brunswick.⁶ The Old Dutch Road, also known as the Bristol Road, passed through Bristol and Frankford, Pennsylvania on the way to Philadelphia and was the most venerable of the three routes. Durrenberger noted that the route "was the only thoroughfare of importance within the limits of New Jersey, even as late as 1675."⁷

Prior to the Revolution, travel, even on the Kings Highways, was not an easy undertaking, as road conditions remained extremely primitive. New Jersey residents did not travel often, usually confining their excursions to the winter season. During the warm months of the year, most citizens had agricultural responsibilities that precluded any thoughts of a journey. In addition, spring thaws and summer rains transformed many semi-passable routes into muddy morasses. In northern climates, like New Jersey, farmers welcomed winter's consistently cold temperatures. During the winter season, local streams froze, creating highways of ice upon which farmers ran their sleighs. Sleighs on frozen streams

³Wheaton J. Lane, *From Indian Trail to Iron Horse: Travel and Transportation in New Jersey 1620-1860* (Princeton, NJ: Princeton University Press, 1939), 32.

⁴ Joseph Durrenberger, *Turnpikes: A Study of the Toll Road Movement in the Middle Atlantic States and Maryland* (Valdosta, GA: Southern Stationary and Printing, 1931), 9.

⁵Seymour Dunbar, *A History of Travel in America*, vol. I (Indianapolis, IN: Bobbs Merrill, 1915), 195.

⁶Lane, *From Indian Trail to Iron Horse*, 51.

⁷Durrenberger, *Turnpikes*, 20.

made much better time than wagons on overland routes and were commonly used as early as 1700.⁸ Farmers had time to spare after the harvest and often used the opportunity to take home-produced commodities, such as cider and cheese, to market for sale.⁹

By the mid-eighteenth century, New Jersey colonists realized that they could not continue to rely solely on water transport for their commercial enterprises. The state needed passable roads to provide links to untapped natural resources located in the interior. It was also evident that road improvements resulted in profitable land development. According to New Jersey historian Wheaton Lane, "The early trails directed the progress of early settlement, and their later conversion into roads was both a cause and an effect of more intensive settlement. Land in the vicinity of main routes was eagerly taken up."¹⁰ Properties along major roads gradually gained value to levels once reserved for lands endowed with an advantageous harbor.

Prior to the improvement of roads, inland settlers used packhorses to transport their grain to market, because the early trails were too narrow to permit the use of carts or wagons. Between 1750 and 1790, professional teamsters guided long lines of horses along routes known alternately as tote-roads, pack roads, and horseways.¹¹ Horses, however, could pull much more weight than they could carry alone. Affluent farmers used crude carts pulled by oxen for limited local transport during the seventeenth and early eighteenth centuries.

Early carts were simple vehicles with two wheels made of sections of tree trunk smoothed into roughly circular shapes. Early wood lynch pins, which attached these crude wheels to the axle, caused carts to jar horribly. Not until the mid-eighteenth century did iron production improve to the point that metal hardware was commonly used in carts.¹² Spoke wheels and metal hardware greatly improved the efficiency of these vehicles. Despite their relative simplicity, carts were considered luxuries during much of the eighteenth century, and according to Bishop's *History of American Manufactures*, "only the best farmers of many sections had carts on their farms."¹³ Tax records from 1697 indicate that only thirty wheeled vehicles existed in the town of Philadelphia. Carriages were rarely seen until after

⁸Dunbar, *A History of Travel in America*, vol. I, 49.

⁹*Ibid.*, 48.

¹⁰Lane, *From Indian Trail to Iron Horse*, 53.

¹¹Dunbar, *A History of Travel in America*, vol. I, 194.

¹²Lane, *From Indian Trail to Iron Horse*, 47.

¹³J. L. Ringwalt, *Development of Transportation Systems in the United States* (Philadelphia: J. L. Ringwalt, 1888), 54. Reprint, New York: Johnson Reprint Company, 1966.

the Revolution, and fancier vehicles styled after European chaises and riding chairs were even less common.¹⁴ In 1772, Philadelphia, a city with a population of 20,000, contained only eighty-four carriages.¹⁵

The most significant development in vehicular technology during this period was the invention of the Conestoga wagon in Lancaster County, Pennsylvania around 1750.¹⁶ These wagons were much more sophisticated than their predecessors. Their design permitted handling heavy loads in the most efficient manner. The characteristic rounded bed of these wagons, which sloped to the middle, forced cargo to remain centered. This quality proved extremely important when crossing steep hills and low valleys, as it prevented cargo from tipping to the front and rear, and thereby steadied the wagons. Steadiness was an admirable quality during this era when poor road conditions and uneven grades caused many wagons to tip over and lose their loads. Conestoga wagons gained rapid popularity and New Jersey shippers adopted them for freight transportation shortly after their introduction.

Despite slight improvements in road construction and vehicular design, transportation costs for goods in colonial New Jersey remained extremely high. Shortly after the Revolutionary War, transportation costs equaled production costs, which restricted inland trade.¹⁷ Overland shipment of manufactured or processed goods to New Jersey's interior regions was generally cost-prohibitive. Consequently, many farming families were forced to become self-sufficient. Residents relied on a few short distance roads for passage to and from local saw and grist mills. Essentially, their farms functioned as independent economic entities, with families utilizing local resources to meet their daily needs.¹⁸

British mercantile policies discouraged colonial manufacture, which placed additional limitations on intra-state trade. Most of New Jersey's resources were sent to Great Britain or other colonies for further processing. Raw materials were generally transported directly to the nearest seaport for exporting.¹⁹ This policy did not encourage the expansion of road

¹⁴Dunbar, *A History of Travel in America*, vol. I, 48.

¹⁵Robert F. Oaks, "Big Wheels in Philadelphia: Du Simitiere's List of Carriage Owners," *Pennsylvania Magazine of History and Biography* 95 (July 1971): 352.

¹⁶Dunbar, *A History of Travel in America*, vol. I, 201.

¹⁷New Jersey State Highway Department Bureau of Public Information, *Development of the New Jersey Highway System*, 4.

¹⁸Cornelius C. Vermeule, "Early Transportation In And About New Jersey," *Proceedings of the New Jersey Historical Society* 9, no. 2 (April 1924): 111.

¹⁹Caroline MacGill, et al., *History of Transportation in the United States Before 1860* (Washington, DC: Carnegie Institution, 1917), 77.

systems between mid-size towns, since goods were generally not transported between those locations prior to the Revolution. With the exception of the New York - Philadelphia routes, road systems remained decentralized and local in nature through the eighteenth century.

High overland transportation costs provided an incentive for shifting to water transportation as quickly as feasible on any given route.²⁰ In the eighteenth century, this proved advantageous to secondary port towns, like Perth Amboy, Burlington, and Salem, because they were able to effectively compete for freight shipments and develop their own foreign trade. Local systems of overland routes arose to serve these areas. Philadelphia and New York, however, finally overshadowed these mid-size ports by the close of the Revolution.²¹

Road conditions became a major national concern after the War of 1812. British coastal blockades obliged American forces to rely on existing overland travel routes during the conflict, and their generally poor quality and decentralized character severely hampered troop and supply movement.²² Transportation historian George Rogers Taylor noted that "The extreme difficulty of moving troops on the Canadian frontier as well as on the southern boundary, due to the almost complete absence of highways, demonstrated that through roads in those areas were essential for effective national defense."²³ After the conclusion of the war, the state's roads were in much worse condition than they had been previously, due to their extensive use during the coastal blockades.

By the close of the eighteenth century, New Jersey residents saw toll roads as the most likely solution to the state's road problem, since they had been successfully implemented in Pennsylvania and New York during the previous two decades. In addition to concerns for national defense, the country needed roads to facilitate the development of the borderlands and establish trade links between manufacturers on the east coast and agricultural concerns in the mid-west.²⁴ Previous efforts at developing long-distance routes had failed, because the power to lay out roads was decentralized, statute labor did not provide a skilled labor

²⁰Jerome Cranmer, *New Jersey in the Automobile Age: A History of Transportation*, vol 23 in *The New Jersey Historical Series* (New York: D. Van Nostrand, 1964), 14.

²¹Lane, *From Indian Trail to Iron Horse*, 50.

²²Wheaton J. Lane, "The Turnpike Movement in New Jersey," *Proceedings of the New Jersey Historical Society* 54, no. 1 (January 193): 36.

²³George Rogers Taylor, *The Transportation Revolution 1815-1860*, vol. 4 in *The Economic History of the United States* (White Plains, NY: M. E. Sharpe, 1951), 18.

²⁴MacGill, et. al., *History of Transportation in the United States Before 1860*, 50.

pool for construction, overseers were not trained in proper road construction, and municipalities could not raise sufficient revenue to execute needed improvements.²⁵

During the first half of the nineteenth century, federal and state funding for internal improvements was not available, so private investors used their own capital to fill this void. Individual investors banded together to charter turnpike companies and used their combined capital to execute road improvements, generally on well-traveled routes. Those travelers and teamsters choosing to use toll roads paid a specified fee based on the distance traveled, the mode of transportation, and the nature of goods being transported. Investors believed that freighters would see the advantage of using these improved roadways, and that tolls would ultimately yield a high return on their initial investment. In theory, tolls should have been sufficient to fund both road maintenance and dividends paid to investors; however revenues rarely yielded significant profits. Turnpike companies had an advantage over local governments, due to the fact that they could raise capital from a diversified investor base and pay professional workers to lay out and construct the roads.

One of the reasons that Pennsylvania and New York leaped to the front of the turnpike movement, was each state's interest in securing a reliable route west. A heated rivalry raged among eastern seaboard states at this time, as each struggled to control trade with western regions. New Jersey's geographical isolation removed the state from this competition. Instead, New Jersey's routes created links to New York and Philadelphia, the two major players in this contest. As a result, the State of New Jersey became "one of the greatest thoroughfares in the United States."²⁶ Three major turnpike routes connected Philadelphia and New York during the first quarter of the nineteenth century: Trenton to Newark via New Brunswick, Bordentown to South Amboy, and Lambertville to Newark via Somerville and Plainfield.²⁷ According to Durrenberger, "probably the most important cause leading to the construction of turnpikes in New Jersey was the desire to facilitate communications between New York and Philadelphia, then the nation's principal centers of population and commerce."²⁸ Secondary concerns also included providing an outlet for the state's mining and agricultural products and opening the Upper Delaware region to New York markets.

²⁵Lane, "The Turnpike Movement in New Jersey," 19.

²⁶Durrenberger, *Turnpikes*, 70.

²⁷*Ibid.*, 74.

²⁸*Ibid.*, 71.

New York investors put considerable capital into the construction of turnpikes in northwestern New Jersey, where a great deal of freight was hauled between New York and the Upper Delaware Valley.²⁹ These were among the longest turnpike routes in the state. Most turnpikes, however, were short-distance routes, serving as feeders to water transportation and later to railroads. A high-concentration of these feeder routes developed around points where goods could be loaded onto boats for New York, like the Bergen Pike between Hackensack and the Hoboken Ferry.³⁰ Some steamboat companies allied themselves with or sponsored associated turnpike companies in an early effort to create direct cross-state routes and compete with rail transportation.³¹ Terminal points along the Hudson and Delaware Rivers, like Hoboken, Jersey City, Newark, Trenton, Bordentown, and Camden, benefited greatly from the commercial interchange of goods between turnpikes and steamboats.³²

Turnpikes did not prove to be a sound investment for most people. Mismanagement, high maintenance costs, and low toll revenues combined to limit dividends. Despite their less-than-stellar performance for investors, turnpikes did provide many indirect benefits for areas along established routes.³³ They had both commercial and social importance, because they opened up new areas for development and fostered regional communication. Turnpikes and other privately funded roads spurred New Jersey manufacturing including such industries as lumber in the Pine Barrens, iron mines in North Jersey, and the glass industry in South Jersey.³⁴ Radial networks of turnpikes serving local and regional traffic needs also centered around mid-size towns, like Morristown, Freehold, and Paterson, thereby increasing the economic strength of these communities and extending their influence over a broader area.³⁵

Improved transportation routes encouraged shipment of goods that had previously been too heavy or cumbersome to transport for a profit. During the seventeenth and most of the eighteenth century, freight rates were a minimum of 30 cents per ton-mile and "none but the most valuable commodities could be carried very far."³⁶ Except for grain, most farm

²⁹Lane, *From Indian Trail to Iron Horse*, 157.

³⁰*Ibid.*, 150.

³¹Vermeule, "Early Transportation In And About New Jersey," 113.

³²Lane, *From Indian Trail to Iron Horse*, 169.

³³Daniel B. Klein, "The Voluntary Provision of Public Goods? The Turnpike Companies of Early America," *Economic Inquiry* 28, no. 4 (October 1990): 795.

³⁴Lane, *From Indian Trail to Iron Horse*, 39.

³⁵Lane, *From Indian Trail to Iron Horse*, 150; Durrenberger, *Turnpikes*, 23.

³⁶Taylor, *The Transportation Revolution 1815-1860*, vol. 4, 133.

produce was too bulky to ship to market. Most farmers had very little hard cash and could ill afford to purchase most manufactured goods, partially because of the prohibitive price increases associated with transportation costs. According to an 1816 United States Senate Committee Report, a ton of goods could be shipped 3,000 miles to Europe for about nine dollars, but the same sum would only be sufficient to move the same ton of goods 30 miles over American roads.³⁷ For this reason, foreign trade dominated economic activities during the eighteenth and early nineteenth centuries. Domestic trade was of negligible concern.

The shift from pack-horse to wagon as the preferred method of transportation significantly lowered transportation costs. A horse and wagon had the capacity to haul seven times more than a single pack-horse, and as a result, the economical range for freight shipment increased by seven times. This created a broader market for goods and provided a production incentive for manufacturers.³⁸ The impact of turnpike development portended even greater changes that would come with the construction of canals and railroads. Reduced transportation costs removed previous geographical barriers, and ultimately created a national market in which all producers could compete equally.³⁹ After the Morris Canal and the Delaware & Raritan Canals opened in the early 1830s, turnpikes lost their independence as trunk lines and were relegated to the position of feeder routes. Canal boats had the capacity to carry much heavier loads than wagons.⁴⁰ Canals, in turn, were soon overcome by railroad shipping, which possessed greater flexibility and was not restricted during the winter season.⁴¹

Before the advent of turnpike era, regularity with regards to freight shipment or passenger travel did not exist. Poor road conditions, especially during the spring thaws, sometimes detained wagons on the road for several weeks.⁴² Departure times were clear; however, arrival times remained totally unpredictable. At the beginning of a journey, passengers and shippers negotiated their transportation costs with the teamster or stage-coach driver. Rates were not fixed; they varied with road conditions, weather, and the threat of hostile attack.⁴³ Coaching services often established relationships with turnpike companies and negotiated

³⁷Ibid., 132.

³⁸Ringwalt, *Development of Transportation Systems in the United States*, 27.

³⁹Cranmer, *New Jersey in the Automobile Age*, 6.

⁴⁰Lane, *From Indian Trail to Iron Horse*, 161.

⁴¹Taylor, *The Transportation Revolution 1815-1860*, vol. 4 in *The Economic History of the United States*, 155.

⁴²Ringwalt, *Development of Transportation Systems in the United States*, 31.

⁴³MacGill, et al., *History of Transportation in the United States Before 1860*, 65.

lower rates. Teamsters generally paid full tolls, although when the weather was good and the public roads passable, some detoured around toll gates on "shun-pikes" to avoid the required usage fee. Many local travelers were exempted from tolls if they claimed to be going to worship, a town meeting, the grist mill or blacksmith's shop. Those on military duty did not have to pay, and neither did those who lived less than a mile from the toll gate.⁴⁴ The cost of the toll related to the anticipated amount of damage expected to be inflicted on the roadway. Therefore, wagons with narrow wheels that caused ruts were charged significantly more than wagons with wider wheels that actually helped compress the roadbed.⁴⁵

Freighting was the primary source of revenue for turnpike companies, followed by the staging industry. Stage coaches saw their greatest use between 1800 and 1830 during the height of the turnpike era in New Jersey.⁴⁶ Improved road conditions enabled coaches to compete effectively with boat travel for short-distance trips within the region. According to historian George Rogers Taylor, "stage coaches were the symbol of rapid transportation in 1815." With an average speed of six to eight miles per hour on good roads, coaches became an attractive travel option for hurried travelers who were willing to place speed before the comfortable ride offered by slower, less-direct boats.⁴⁷

A high concentration of stage coach routes developed through the "waist" of New Jersey between New York and Philadelphia. Early stage coach lines served through traffic traveling across the state, primarily between these two cities. This journey generally involved two transfers: first, water passage from Manhattan to a point in northern New Jersey near the Raritan River; second, a stagecoach leg across the state to Trenton or another port on the Delaware; and third, a trip by steam boat down river to Philadelphia.⁴⁸ Local stage routes radiating from mid-size towns like Cooper's Ferry and Powles Hook developed considerably more slowly.⁴⁹ Many roads led out of major cities like Boston, New York, Philadelphia, and Baltimore, but less-populous areas remained "dependent on

⁴⁴Klein, "The Voluntary Provision of Public Goods? The Turnpike Companies of Early America," 791.

⁴⁵ Donald Jackson, "Roads Most Traveled: Turnpikes in Southeastern Pennsylvania," in *Early American Technology: Making and Doing Things From the Colonial Era to 1850*, edited by Judith A. McGaw (Chapel Hill, NC: University of North Carolina Press, 1994), 230.

⁴⁶Lane, *From Indian Trail to Iron Horse*, 159.

⁴⁷Taylor, *The Transportation Revolution 1815-1860*, vol. 4, 142.

⁴⁸*Ibid.*, 58.

⁴⁹Lane, *From Indian Trail to Iron Horse*, 91.

the pole-boat, saddle-horse, and pack-train."⁵⁰ Freighters primarily utilized turnpikes in northwestern New Jersey; a region the staging industry served only in a limited capacity.

Coaches began to appear in the colonies during the mid-eighteenth century, and records suggest that only the upper class could afford these luxury items. The first coaches were more a novelty, than a practical form of transportation. Road conditions limited their use to a small proscribed area around a family's estate and its nearby environs. Coaches were not used as stages until just before the Revolution.⁵¹ Prior to that time, only wealthy families had access to coaches; they were not for public hire. According to Lane, the first stage coach used for public transportation in New Jersey made its maiden run in 1772.⁵² He does not specify the location of the route, but it was likely in Central Jersey between New York and Philadelphia, since that area had the greatest concentration of traffic in the state. Although regional passenger service existed prior to that date, the vehicles used were merely less sophisticated wagons, which provided a horribly jarring ride. Coaches, even in the early years, represented a vast improvement over these wagons.

In addition to the poor quality of the roadbed, few streams were bridged prior to the advent of the turnpike movement at the beginning of the nineteenth century. During the colonial period, when travelers encountered a waterway that could not be forded, their coaches had to be ferried across with each set of wheels in a canoe.⁵³ Throughout the eighteenth century, many ferries were established. Technological advancements caused canoes to give way to rope-ferries, whose role was later taken over by steam ferries.⁵⁴ Ferries provided a valuable service for New Jersey during the eighteenth and nineteenth centuries. They facilitated movement across the state's large rivers, for which the cost of constructing permanent bridges was prohibitive. By the time of the Revolution, twenty-two ferries operated on the Delaware River north of Trenton and fifteen south of that point.⁵⁵ Ferrymen possessed relatively high standards of living. Most owned large tracts of property around their ferry landings, and many ran inns or stage lines to supplement their income.⁵⁶

⁵⁰Dunbar, *A History of Travel in America*, vol. I, 201.

⁵¹Lane, *From Indian Trail to Iron Horse*, 48.

⁵²*Ibid.*, 88.

⁵³Dunbar, *A History of Travel in America*, vol. I, 46.

⁵⁴Ringwalt, *Development of Transportation Systems in the United States*, 35.

⁵⁵Lane, *From Indian Trail to Iron Horse*, 44.

⁵⁶*Ibid.*, 45.

Public bridge construction during the eighteenth and nineteenth centuries fell under the jurisdiction of local officials. Crude bridges of fallen logs accommodated travelers on foot and horseback, but increasing numbers of vehicles eventually required the construction of permanent bridges in key areas that were not served by fords or ferries.⁵⁷ Prior to 1845, bridges were usually built of wood, wood and iron, stone, or chains. Due to its availability and low cost, wood was the most common building material used for bridges during this period.⁵⁸ According to Lane, New Jersey had relatively few large stone bridges due to the significant expense of materials and labor. The greatest of these stone bridges crossed the Assanpink Creek at Trenton.⁵⁹ During the first quarter of the nineteenth century, the turnpike movement supported bridge construction, and investors formed numerous toll bridge companies in an attempt to address unmet transportation needs.⁶⁰ Private capital built many roads, as well as their attendant bridges, during the first half of the nineteenth century. Even with growing numbers of bridges and faster ferries, traffic was still hampered by water crossings, and the rate of travel remained extremely slow and cumbersome.

The advent of the turnpike era and design improvements for coaches greatly improved stage travel by the beginning of the nineteenth century. Increased traffic volume led to the establishment of quality accommodations along major routes. Various grades of taverns and inns arose, each catering to a different type of clientele, including teamsters, drovers, and stage coach passengers. The quality of accommodations on a given route often influenced a passenger's choice of stage lines. Indeed, it was not uncommon for a stage line to acquire and operate these enterprises along their routes in order to stay competitive with other rival lines.⁶¹ According to Dunbar, inns and taverns were "the chief centers of life and news of the communities in which they were situated. They were also the most prominent landmarks of any journey, and it thus became the universal custom for travelers and businessmen to compute all distances from them, instead of from one town to another."⁶²

Prior to the introduction of coaches, staging companies used crude wagons and primarily hauled freight. With the adoption of coaches in the late eighteenth century, passenger

⁵⁷Ibid., 46.

⁵⁸Ringwalt, *Development of Transportation Systems in the United States*, 36.

⁵⁹Lane, *From Indian Trail to Iron Horse*, 47.

⁶⁰Ringwalt, *Development of Transportation Systems in the United States*, 34.

⁶¹Vermeule, "Early Transportation In And About New Jersey," 114.

⁶²Dunbar, *A History of Travel in America*, vol. I, 212.

service took priority.⁶³ Stages supplemented passenger revenues by carrying mail and newspapers. Although lone horseback riders were the primary carriers of the nation's mail until 1825, stagecoaches took over that role in the mid-1820s and maintained their position through the 1850s.⁶⁴ Improved roads resulted in improved mail service, enhancing regional communication and linking New Jersey even more closely with Philadelphia and New York.

The period between 1830 and 1840 was the high point for toll road operations. After that date revenues declined, and companies found it very difficult to maintain and operate their routes while still paying dividends. Investors sponsored many speculative toll roads in sparsely populated areas in anticipation of future development. In many cases this development never materialized, leaving investors with significant capital losses.⁶⁵ Another harbinger of the turnpike movement's demise was the construction of the Camden & Amboy and the New Jersey Railroads lines during the 1830s. Stage coaches and teamsters using existing turnpikes could not compete with this new technology. Wheaton Lane, a notable New Jersey transportation historian, noted that "almost as soon as train service was established, stage companies ceased operating between New York and Philadelphia, and those turnpikes which paralleled the new lines lost their main source of revenue."⁶⁶ Turnpikes that had managed to survive competition from canals by shifting from freight transportation to passenger service, rapidly succumbed to the railroad industry.⁶⁷ Between 1829 and 1849 the State of New Jersey chartered only five turnpike companies.⁶⁸ When compared to the first decade of turnpike development in the state (nine turnpikes were chartered in 1806 alone), this represents a significant decline.⁶⁹

Turnpikes managed a brief revival during the 1850s due to the introduction of a new form of road construction – the plank road. These roads offered a more even and reliable surface than earth or gravel turnpikes, because the roadway consisted of smooth planks laid on top of timber stringers. This technique first appeared in New York State where it had been introduced from Canada. The New York Legislature began chartering plank turnpike roads

⁶³Lane, *From Indian Trail to Iron Horse*, 92.

⁶⁴Taylor, *The Transportation Revolution 1815-1860*, vol. 4, 149.

⁶⁵Harmer E. Davis, et. al., *Toll Road Developments and Their Significance in Provision of Expressways* (Berkeley, CA: Institute of Transportation and Traffic Engineering University of California, 1953), 7.

⁶⁶Lane, *From Indian Trail to Iron Horse*, 162.

⁶⁷Taylor, *The Transportation Revolution 1815-1860*, vol. 4, 155.

⁶⁸Lane, *From Indian Trail to Iron Horse*, 152.

⁶⁹Durrenberger, *Turnpikes*, 73.

around 1846, but the movement gained real momentum in 1850.⁷⁰ For a brief period, plank roads rivaled the notoriety of the famed Erie canal. New York built at least 3,000 miles of these roads in the decade between 1844 and 1854, and states throughout the east and midwest readily adopted the new technology.⁷¹

New Yorkers actively promoted plank roads as an economical alternative to macadamized routes. In 1847, their legislature issued a report extolling the virtues of plank roads. These roads were originally considered a dependable, less expensive alternative to broken stone roads, which had historically received enormous state subsidies in New York.⁷² This wave of enthusiasm soon crossed the border into New Jersey, where in 1849 the legislature passed ten plank toll road charters.⁷³ The mania, however, did not strike New Jersey to the same degree as New York. By the time the bubble burst in 1857, New Jersey had chartered only 25 plank road companies, whereas New York had chartered 352.⁷⁴

The majority of New Jersey's plank roads were located in the southern region of the state. South Jersey chartered few turnpikes during the initial phase of road improvement between 1800 and 1840, but later wholeheartedly embraced the plank road turnpike movement in the 1850s.⁷⁵ Even with a significantly improved roadway, plank roads could still never directly compete with railroads and canals. Northern and central New Jersey possessed extensive canal and railroad systems, and for that reason the role of plank roads in those areas was limited.

Few railroad lines, however, penetrated deep into South Jersey during the first half of the nineteenth century. Therefore, a greater opportunity for development of plank roads existed in that region. Few internal improvements had been made in South Jersey prior to 1840, when agricultural development finally reached the point that better roads were needed. According to Durrenberger, "this later period of turnpike building centered chiefly, but not wholly, in the southern portions of the state."⁷⁶ The Monmouth County Plank Road Company constructed the state's longest plank road turnpike, which ran from

⁷⁰Ringwalt, *Development of Transportation Systems in the United States*, 167.

⁷¹Daniel B. Klein and John Majewski, "Plank Road Fever in Antebellum America: New York State Origins," *New York History* 75, no. 1 (January 1994): 47.

⁷²*Ibid.*, 53.

⁷³Durrenberger, *Turnpikes*, 74.

⁷⁴*Ibid.*, 145.

⁷⁵Lane, *From Indian Trail to Iron Horse*, 152.

⁷⁶Durrenberger, *Turnpikes*, 75.

Freehold to Keyport.⁷⁷ Short networks of turnpikes radiated out from populations centers, like Camden and Mount Holly, in the southern half of the state. Through traffic on plank roads was limited, and local freighting and rail line receipts accounted for the largest percentage of revenues.⁷⁸

In the central and northern regions of New Jersey, railroads and canals retained their dominant status in the transportation realm. No matter how extensive these networks became, farmers still needed roads to transport their produce short distances to the nearest depot or landing. Plank roads met that fundamental need and also established connections between small communities that did not merit their own railroad line.⁷⁹ Daniel Klein, a scholar specializing in the history of plank roads, noted that: "plank roads, like the wooden sidewalks they resembled, may sound quaint or even absurd now, but antebellum Americans were almost as absorbed in improving roads for short-distance travel as they were in canal and railroad systems that provided transportation over long distances."⁸⁰ Most plank roads served as feeders for railroad lines, and were actually referred to as "farmers' railroads" during the mid-nineteenth century.⁸¹ Many thought of railroads as a "thoroughfare for the citizen away from home - for travel; but the plank road is for home use."⁸² Eventually, networks of railroad lines filtered down into South Jersey, and maintenance and financial problems drove most plank road turnpikes out of business by the 1860s.

The use of gravel and earth roads continued throughout the nineteenth century. Between 1830 and 1916, road systems were not an independent form of travel. Most, with the exception of certain long-distance turnpikes, served as feeder routes for railroads or connected to alternate transportation systems.⁸³ With transportation concerns focused primarily on rail travel during the second half of the nineteenth century there was little innovative activity centered on roadways until the advent of the Good Roads Era.

⁷⁷Lane, *From Indian Trail to Iron Horse*, 165.

⁷⁸*Ibid.*, 167.

⁷⁹Jackson, "Roads Most Traveled," 229.

⁸⁰Klein and Majewski, "Plank Road Fever in Antebellum America," 40.

⁸¹Ringwalt, *Development of Transportation Systems in the United States*, 167.

⁸²Lane, "The Turnpike Movement in New Jersey," 43.

⁸³Julius H. Parmelee and Earl R. Feldman, "The Relation Of The Highway To Rail Transportation," in *Highways in Our National Life*, edited by Jean Labatu and Wheaton J. Lane (Princeton, NJ: Princeton University Press, 1950), 227.

Road Legislation

The colonial government made provisions for road surveys and construction at the end of the seventeenth century. In the 1680s, road boards were established in East and West Jersey. These boards had the authority to lay out new roads and set rates and taxes to fund construction and maintenance.⁸⁴ After East and West Jersey were unified as the colony of New Jersey in 1702, Governor Hunter passed an act requiring towns to select surveyors of highways, a position that held similar responsibilities to the earlier road boards. The appointment of surveyors, however, did little to encourage road construction in the state. Several decades later, road conditions had not appreciably improved, and the new governor passed a revised law specifying stricter requirements for surveyors and compelling them to inspect all roads in their jurisdiction every two months.⁸⁵ Nevertheless, without funds or labor available for making road improvements, inspection requirements proved meaningless.

Each town held the responsibility of addressing its own transportation needs. According to Lane, few linking highways were constructed in New Jersey for more than two centuries after settlement because, "each town was mainly interested in local facilities, and gave little thought to a comprehensive system of highways which would connect all settlements."⁸⁶ There was no central authority in the state to put forward and advocate such a program, and prior to the Revolution residents found other transportation methods to meet their needs.⁸⁷

The colonial government supported the creation of a few early military roads, such as Braddock's Road and Forbes Road to the Ohio River, but generally avoided taking responsibility for any other internal improvements.⁸⁸ Military conflicts with the French, Native Americans, and Great Britain consumed most surplus resources during the eighteenth century. After the Revolution, federal attitudes about transportation followed the lead established during the colonial era. Decentralization and a laissez-faire approach characterized road improvement policy at the state and national levels. In 1807, Albert Gallatin, then Secretary of the Treasury, lobbied the federal government to sponsor a comprehensive national transportation system.⁸⁹ The constitutionality of providing federal

⁸⁴Lane, *From Indian Trail to Iron Horse*, 34-35.

⁸⁵Ibid., 37.

⁸⁶Ibid., 34.

⁸⁷Ringwalt, *Development of Transportation Systems in the United States*, 24.

⁸⁸ John B. Rae, *The Road and Car in American Life* (Cambridge, MA: MIT Press, 1971), 14.

⁸⁹Charles L. Dearing, *American Highway Policy* (Washington, DC: Brookings Institution, 1941), 32.

funding for internal improvements was seriously questioned; however, and eventually Gallatin's plan was dropped entirely. With the exception of the Cumberland Road, which connected the Ohio Valley with the eastern seaboard and was authorized in 1806, the federal government did not put money into roads throughout the nineteenth century.⁹⁰

At issue was not only the constitutionality of funding these types of improvements, but how and where the improvements might be made. Considerable rivalry existed between eastern seaboard states during the early nineteenth century, as each tried to establish control over western commerce. Northeastern states had already gone to great expense to create their few trunk lines and therefore possessed better roads than southern states. States in New England and the Mid-Atlantic resented the possibility that the federal government might provide money to improve southern roads, thereby giving them an advantage in the contest for commercial superiority.⁹¹

During the late eighteenth century several Mid-Atlantic states including New Jersey, New York, and Pennsylvania attempted to implement policies for state-financed road improvements.⁹² Lotteries raised a limited amount of money for improvements. While some New Jersey lotteries were successful, their impact was not widely felt. In the lottery process, tickets were sold creating a pool from which a certain percent was retained for the road fund, with the remainder redistributed as cash prizes.⁹³ Eventually, states realized that they could not adequately finance substantial road improvements through lotteries and turned to private capital and turnpike companies.⁹⁴

By the mid-nineteenth century, railroad systems began to penetrate the west, and roads were completely dismissed as a long-distance travel option. After the close of the turnpike era, roads had only local importance and were therefore the sole responsibility of local governments.⁹⁵ Centralization of road construction and planning would only begin to take place in New Jersey after 1891 when state aid funds for improvements first became available.

⁹⁰W. Stull Holt, *The Bureau of Public Roads: Its History, Activities, and Organization* (Baltimore, MD: Johns Hopkins Press, 1923), 3. Federal appropriations for road construction were deemed unconstitutional in 1804.

⁹¹Taylor, *The Transportation Revolution 1815-1860*, vol 4, 21.

⁹²Durrenberger, *Turnpikes*, 39.

⁹³Lane, "The Turnpike Movement in New Jersey," 20.

⁹⁴*Ibid.*, 21.

⁹⁵Rae, *The Road and Car in American Life*, 26.

Until that time, road improvements depended on infusions of private capital filtered through turnpike companies. In 1792, the Philadelphia and Lancaster Turnpike Company initiated the turnpike era in the United States.⁹⁶ The route measured 62 miles in length, had nine toll gates, followed an early Kings Highway, and was the first macadamized road in the western hemisphere. The success of the Lancaster Turnpike encouraged investors in surrounding states to undertake similar projects. New Jersey first began to promote turnpikes in 1795, when a company was chartered for a road between Philadelphia and New York. Unfortunately, only one quarter of the stock was subscribed, and the project had to be abandoned.⁹⁷ This squelched turnpike projects for the next several years, putting New Jersey behind other states in the area of road improvement.

The state's first turnpike was chartered in 1801. By that date, New York had thirteen turnpikes routes, and Pennsylvania had eight.⁹⁸ The Morris Turnpike was built in three sections: Elizabeth Town to Morristown, Succasunty to Stanhope, and Stanhope to Newtown.⁹⁹ Other major turnpikes that opened during this period include the Union Turnpike (1804) from Morristown to Milford; the Washington Turnpike (1806) from Morristown to Philipsburg; the New Jersey Turnpike (1806) from New Brunswick to Philipsburg; and the Paterson-Hamburg Turnpike (1806).¹⁰⁰ In the three decades after chartering the Morris Turnpike, the New Jersey Legislature incorporated fifty-one turnpike companies. Only half that number, however, actually succeeded in constructing toll roads. By 1830, 550 miles of improved toll roads crossed the state, but only one route, a toll road in Burlington County, extended into South Jersey.¹⁰¹

New Jersey state legislation fostered the creation of turnpike companies. Individual charters were created for each turnpike company. These usually authorized a long operating life (between 50 and 99 years), set high maximum tolls, and often allowed companies to actually take over and improve existing public roads as part of the toll road.¹⁰² After the governor approved a charter, three commissioners laid out the route and created an accurate map of the survey.¹⁰³ The state required turnpike corporations to keep

⁹⁶H. H. Kelly, US Bureau of Public Roads, "Toll Roads: A Study of the History and Present Status of Toll Roads in the US and Other Countries," *Public Roads* 12 (March 1931): 1-2.

⁹⁷Durrenberger, *Turnpikes*, 44.

⁹⁸Lane, *From Indian Trail to Iron Horse*, 144.

⁹⁹Lane, "The Turnpike Movement in New Jersey," 24.

¹⁰⁰Lane, *From Indian Trail to Iron Horse*, 147.

¹⁰¹*Ibid.*, 151.

¹⁰²*Ibid.*, 152.

¹⁰³Durrenberger, *Turnpikes*, 88.

their roads in good repair, but in reality "inspection machinery was cumbersome in its organization and ineffective in its operation. Cognizance of defects was taken only upon complaint of some aggrieved person, moreover if the committee of inspection returned a report in favor of the company, the fees allowed the inspectors were charged against the complainant."¹⁰⁴

Municipalities were generally supportive of turnpike companies, because they relieved local overseers from their responsibility for maintaining local roads.¹⁰⁵ Most public roads were very poorly maintained. Residents elected road supervisors at town meetings, and almost none had experience or knowledge of road building techniques. Most were simply local farmers, as were the laborers executing the improvements. Statute labor legislation compelled residents to put in work days on road maintenance and construction or pay a road tax fine. Very often these work days turned into social events, and few improvements were actually realized.¹⁰⁶ The supervisor's job paid only a token wage, so there was little incentive for initiative, except for the fact that supervisors had the power to direct improvement efforts towards roads in which they had a personal interest during their term in office.¹⁰⁷

The majority of New Jersey's turnpikes were short-distance routes with small capitalizations. The state supported turnpike construction through the generosity of its charters, but avoided actually subsidizing their construction, as in Pennsylvania and Virginia.¹⁰⁸ Turnpikes did not ordinarily prove highly profitable for investors. According to Klein, the few successful turnpikes possessed significant advantages including, "low cost in land acquisition, good condition of the pre-existing road bed, minimal bridge building, and substantial traffic volume."¹⁰⁹ Once constructed, toll companies' charters often imposed restrictions that made it difficult to increase revenues. These restrictions included granting concessions to local travelers, limiting the number and position of toll gates, and putting ceilings on toll charges.¹¹⁰ The use of "shun-pikes," free parallel routes

¹⁰⁴Ibid., 93.

¹⁰⁵Ibid., 79.

¹⁰⁶Ringwalt, *Development of Transportation in the United States*, 26.

¹⁰⁷Ibid.

¹⁰⁸Lane, *From Indian Trail to Iron Horse*, 155; Ringwalt, *Development of Transportation Systems in the United States*, 29.

¹⁰⁹Daniel B. Klein, "The Voluntary Provision of Public Goods?," 794.

¹¹⁰Ibid., 791.

that circumvented toll gates, was widespread, since the companies could not legally increase their number of gates or reposition them.¹¹¹

Even unprofitable routes did, however, provide important indirect benefits to the communities through which they passed by raising farm values and lowering transportation costs for local manufacturers and farmers. Klein hypothesizes that most investors realized this fact, but were still willing to purchase stock in order to gain the benefits of improved roads, "Since unprofitability was usually foreseen, stock subscription - necessary to construct the road - was essentially a means of indirectly paying for road benefits."¹¹² Those who stood to benefit from improved roads in the long term were not phased by the possibility of absorbing a short-term loss on stock investments. New York investors supported New Jersey's northern turnpikes in order to draw Upper Delaware Valley trade away from Philadelphia, and farmers, merchants, and stage drivers supported shorter, local routes in anticipation of population increases and commercial development.¹¹³

Shares in New Jersey turnpikes generally fell within the \$25, \$50, and \$100 range; slightly higher than New York stocks, which were usually between \$20 and \$50.¹¹⁴ Local residents owned most shares, and although wealthy land owners often purchased substantial blocks of stock, the investor base remained relatively diverse. Fifty to one hundred people generally held shares in a company, and one person rarely held more than 15 percent of the stock.¹¹⁵ Promoters often organized town meetings for the express purpose of securing stock purchases from the local community. Prominent residents made public declarations of their intention to purchase stock, providing non-subtle incentives for citizens of like social stature to make similar financial commitments to the project.¹¹⁶ Nevertheless, many companies had difficulty securing sufficient capital to build their routes. This accounts for the large disparity between the number of companies chartered and the actual number of completed roads. Sometimes companies began construction on a restricted budget, but these enterprises quickly failed because they could not meet their maintenance costs.¹¹⁷

¹¹¹Ringwalt, *Development of Transportation Systems in the United States*, 32.

¹¹²Klein, "The Voluntary Provision of Public Goods?," 789.

¹¹³Lane, *From Indian Trail to Iron Horse*, 156.

¹¹⁴Durrenberger, *Turnpikes*, 105.

¹¹⁵Klein, "The Voluntary Provision of Public Goods?," 798.

¹¹⁶*Ibid.*, 803.

¹¹⁷Lane, *From Indian Trail to Iron Horse*, 34.

During the 1830s and 1840s, toll roads struggled financially and faced increasing competition from rapidly expanding canal and railroad systems. Mismanagement, heavy debts, and unmet traffic expectations brought down many companies.¹¹⁸ Their routes then became free roads, but townships could not afford appropriate maintenance and gradually the turnpike system fell into disuse and disrepair. The financial panic of 1837 bankrupted many of these first toll roads, which then reverted to public control.¹¹⁹ The rapid decline of plank roads during the late 1850s further soured public sentiment for turnpike routes. When originally constructed, most turnpikes catered primarily to regional through traffic rather than local traffic. By the second half of the century, however, that traffic had been taken over by the railroads, and local users were left to bear the brunt of toll levies. Additional tax burdens and statute labor obligations placed on local residents for the upkeep of public roads added insult to injury. These factors galvanized the public to advocate the elimination of toll roads by the last quarter of the nineteenth century.¹²⁰

Conditions were not favorable for investors in these companies. Most found themselves saddled with worthless stocks and an obligation to maintain routes that had been established.¹²¹ Quickly, many state legislatures passed acts providing these individuals with a way out of this situation. New Jersey modeled their legislation after New York's, which provided that if two-thirds of the stock holders filed a declaration to abandon a route, the property would then revert to public control.¹²² The legislature also passed an act authorizing counties to purchase toll roads and bridges on behalf of towns and create additional public routes. The New Jersey Legislature developed a state aid plan in 1897 to assist counties in their efforts to eliminate the state's few remaining toll roads. The state agreed to pay one-third of the purchase price of a toll road, the remainder being paid for by adjacent land owners (10 percent) and the country (56 2/3 percent). New Jersey's last turnpike was converted to public use in 1921.¹²³

Road Construction

As previously mentioned, New Jersey's first roads evolved from paths made by Native Americans or trails blazed by early pioneers. Many decades passed before these narrow

¹¹⁸Ibid., 161.

¹¹⁹Davis, et al., *Toll-Road Developments*, 7.

¹²⁰Lane, *From Indian Trail to Iron Horse*, 168.

¹²¹Klein, "The Voluntary Provision of Public Goods?," 792.

¹²²Durrenberger, *Turnpikes*, 157.

¹²³Lane, "The Turnpike Movement in New Jersey," 51.

routes, most between 12 and 18 inches in width, were capable of handling cart or wagon traffic.¹²⁴ Goods were shipped long distances over water and were delivered locally using pack-horses. Most of these early roads were, in actuality, portages connecting navigable bodies of water and had been in use long before colonization.¹²⁵ Since most colonists traveled overland on horseback during the seventeenth and mid-eighteenth centuries, there was little pressure to transform trails into roads. Limited funds, an inadequate pool of available labor, and difficulties in acquiring rights-of-way further inhibited road construction.¹²⁶ By the latter half of the eighteenth century, improvements in vehicle design led to the adoption of the Conestoga wagon and early forms of carriages for freight shipment and passenger conveyance.

Increased use of wheeled vehicles spurred the improvement of trails into roads that were at least passable in good weather. Clearing routes through the east-coast's densely-forested regions proved an arduous task. Widening trails required the removal of stumps, boulders, and other impediments from the roadway, which was then laboriously smoothed using hand-held rakes or horse-drawn scrapers.¹²⁷ According to Dunbar's *A History of Travel in America*, the creation of corduroy roads often represented the first phase of highway improvement. Minor problems in dry, generally stable sections of road could be solved by filling chuck holes and ruts with saplings or cut logs.¹²⁸ Swamps, marshes, and areas prone to flooding, however, often required the creation of a full-fledged corduroy road. This construction method involved laying logs, cut in ten to twelve-foot lengths, parallel to one another along the route. Road builders covered the logs with a layer of dirt between two and three inches thick, creating a passable but extremely bumpy road surface.¹²⁹

Pre-existing trails and property lines generally dictated the alignment of early public roads. Routes were unnecessarily long, winding around large farms rather than passing through them along a direct route. Such practices did nothing to improve travel times.¹³⁰ Town surveyors technically had the right to take land for road building and improvement purposes, and tacit agreements existed for compensation in such circumstances.¹³¹ However, few surveyors were interested in angering their neighbors in order to straighten

¹²⁴Dunbar, *A History of Travel in America*, vol. I, 19.

¹²⁵Ringwalt, *Development of Transportation Systems in the United States*, 25.

¹²⁶*Ibid.*, 23.

¹²⁷Donald Jackson, "Roads Most Traveled," 203.

¹²⁸Alice Morse Earle, *Stage Coach Days* (New York: Dover Publications, 1969), 227.

¹²⁹Dunbar, *A History of Travel in America*, vol. I, 195.

¹³⁰Lane, *From Indian Trail to Iron Horse*, 40.

¹³¹*Ibid.*, 37.

out a route by laying it through their fields. For that reason, these early alignments remained in place, unchanged for many generations. Caroline MacGill observed that early roads were "built not so much on mathematical as on social principles; that is, instead of being located on the best and shortest routes, they were too much subordinated to local and individual interests, which often resulted in bad locations and in long, indirect, and devious routes."¹³² Decentralization characterized road construction and maintenance throughout the seventeenth and eighteenth centuries. Local politics played a significant role in determining course and condition of public routes.

Turnpike companies put considerably more care into the design and construction of their routes, since they were developed as money-making enterprises. In order to encourage travelers and teamsters to use turnpikes, road conditions had to decrease travel time and lower transportation costs, thereby compensating for the amount of the toll paid. Turnpike companies promoted their routes as being more direct than public roads, with gentler grades that facilitated and increased hauling capacity. Shifts in overland freight transportation from pack-horse to horse-drawn wagons increased concern for grade and elevation.¹³³ Consequently, turnpike companies endeavored to keep the grades on their routes between three and six degrees depending on the nature of the terrain.¹³⁴

Freight wagons proved highly effective for local and limited regional travel, and improved roads enabled them to carry heavier and heavier loads. Soon, the wagon rims of these heavily-laden cargo wagons began to cut through the packed surface of road beds, carving large ruts. During heavy rains these ruts filled with water, gradually undermining road foundations and creating quagmires of mud that could stall a stage or wagon for the better part of a day. Builders addressed this common problem by advocating a roadbed design that possessed a high center crown with deep drainage ditches on either side to efficiently carry away rainwater and eliminate standing water.¹³⁵

Regular grading was required to maintain this profile, which served, in effect, as the road's only drainage system. The triangular scraper, the first specialized tool for grading, was developed in 1769.¹³⁶ By the 1880s, the horse drawn scraper came into popular use as a

¹³²MacGill, et al., *History of Transportation in the United States Before 1860*, 53.

¹³³Jackson, "Roads Most Traveled," 205.

¹³⁴Lane, *From Indian Trail to Iron Horse*, 154.

¹³⁵Jackson, "Roads Most Traveled," 206.

¹³⁶Wheaton J. Lane, "The Early Highway in America, to the Coming of the Railroad," in *Highways in Our National Life: A Symposium*, edited by Jean Labatut and Wheaton J. Lane (Princeton, NJ: Princeton University Press, 1950), 69.

labor-saving device.¹³⁷ Successful turnpike companies could afford to hire contractors to do construction and improvement work, but maintenance practices were very different for public roads.¹³⁸ Several times a year the town overseer arranged a day for local citizens to work on the roads. Residents hitched oxen to the town plow, which dug soil and debris out of drainage ditches and heaped it on the center of the road where residents smoothed it with rakes. Improvements made in this somewhat haphazard fashion were rarely long-lasting, but road work days still presented a wonderful opportunity for distant neighbors to socialize.¹³⁹ The critical need for ongoing maintenance, especially on earthen roads, should not have been ignored, but it often was by both townships and turnpike companies. Inadequate revenues often caused turnpike companies to neglect maintenance, and as a result, their roads declined rapidly, leading to financial failure.¹⁴⁰

The term "turnpike" derives from the use of a pike or bar placed across the roadway where a toll is collected, and does not connote a certain type of design or construction.¹⁴¹ Lane noted that only a few New Jersey turnpike companies surfaced their routes with crushed stone, and a large proportion of the state's toll road mileage was simply earth.¹⁴² Durrenberger observed that two classes of turnpike routes existed during the first quarter of the nineteenth century, "highly improved roads of gravel, stone, or wood, and improved roads of natural earth."¹⁴³ Both types of roads were considered "improved," but the quality of that improvement varied considerably between routes.

Systems for laying broken-stone roads, the highest quality construction available in the nineteenth century, were developed by Tresaguet, a Frenchman, in 1769 and two Englishmen, Telford in 1805 and Macadam in 1815.¹⁴⁴ The Telford system utilized large flat stones for the foundation, onto which smaller, broken pieces of stone were laid. The pressure of passing traffic bound the stones together into a single structure.¹⁴⁵ By the

¹³⁷Albert C. Rose, "The Highway From the Railroad to the Automobile," in *Highways in Our National Life: A Symposium*, edited by Jean Labatut and Wheaton J. Lane (Princeton, NJ: Princeton University Press, 1950), 84.

¹³⁸Ringwalt, *Development of Transportation Systems in the United States*, 27.

¹³⁹Dearing, *American Highway Policy*, 43.

¹⁴⁰Ringwalt, *Development of Transportation Systems in the United States*, 31.

¹⁴¹Lane, *From Indian Trail to Iron Horse*, 153.

¹⁴²Ibid.

¹⁴³Durrenberger, *Turnpikes*, 84.

¹⁴⁴John H. Bateman, *Introduction to Highway Engineering: A Textbook For Students of Civil Engineering* (New York: John Wiley and Sons, 1948), 230.

¹⁴⁵Ibid.

1830s, the Macadam system, which used only small pieces of angular stone, succeeded the Telford system as the preferred method of stone road construction.¹⁴⁶

Turnpike roads generally measured from four to six rods wide. A chain measuring four rods long, sixty-six feet, was commonly used for surveying during this era. A rod equals sixteen and a half feet, which amounts to a historic right-of-way width between sixty-six and ninety-nine feet.¹⁴⁷ These rights-of-way contained sixteen to twenty-eight-foot-wide artificial roadways flanked by wide earthen shoulders called "summer roads."¹⁴⁸ These shoulders were used in good weather, for passing another vehicle, or as a substitute road during road work.

The majority of New Jersey's turnpikes were composed solely of graded earth and gravel, and township roads rarely even had a stabilized surface.¹⁴⁹ Townships used very rudimentary forms of paving for most of their roads. The natural resources available in the vicinity of the road generally dictated the type of paving material. Materials used in New Jersey during the nineteenth century included field stones, gravel, logs for corduroy pavements, oyster shells, slag, and even bog iron.¹⁵⁰ These pavements did not have a solid foundation or a high quality surface. As a result, heavy storms often rendered them impassable and sometimes washed the paving away entirely.

Broken stone roads were the most expensive type to build, because of high transportation costs for materials and high labor costs. According to Jackson, "quarrying, breaking, placing, and replacing rocks along a roadway represented a time-consuming and expensive process that required most of the capital raised by many turnpike companies."¹⁵¹ This capital allowed turnpike companies to hire laborers to build the roads; unlike public roads that depended on the involvement of local citizens. Excavating road beds, carting away the soil, and breaking rocks with round-headed hammers was grueling labor, and unskilled immigrants often accepted these jobs.¹⁵² During the first half of the century, turnpike

¹⁴⁶New Jersey State Highway Department Bureau of Public Information, *Development of the New Jersey Highway System*, 9.

¹⁴⁷Jackson, "Roads Most Traveled," 204.

¹⁴⁸Lane, *Travel and Transportation in New Jersey 1620-1860* (Princeton, NJ: Princeton University Press, 1939), 154.

¹⁴⁹New Jersey State Highway Department Bureau of Public Information, *Development of the New Jersey Highway System*, 8.

¹⁵⁰New Jersey Commissioner of Public Roads, *Third Annual Report of the Commissioner of Public Roads* (Trenton, NJ: MacCrellish and Quigley Co., 1896), 9.

¹⁵¹Jackson, "Roads Most Traveled: Turnpikes," 207.

¹⁵²Alice Morse Earle, *Stage Coach and Tavern Days*, 234.

companies constructed broken stone roads only where the level of traffic made it economically expedient, namely on their most heavily traveled sections. A mid-nineteenth century account in the *Gazetteer of the State of New Jersey* notes that: "we do not recollect to have seen in any direction, five consecutive miles of road paved with stone."¹⁵³

Until 1858, all of the stone for road construction had to be broken by hand, but in the latter half of the nineteenth century, the macadam system of construction moved towards mechanization. The first advancement came with the invention of the jaw rock crusher in 1858, followed by the introduction of the steam roller between 1859 and 1866, the leaning wheel grader in 1885, and finally the track-laying tractor in 1904.¹⁵⁴ The preferred stone for road construction in New Jersey was trap rock, a fine-grained igneous rock prized for its strength and durability.¹⁵⁵ In the 1890s, counties generally survey a proposed right-of-way to determine the location of any trap rock deposits prior to fixing the road's alignment.¹⁵⁶

Despite technological advances in broken-stone construction during the nineteenth century, roads of this type still could not compete with canal and railroad routes. The introduction of plank roads during the late 1840s represented a notable advancement in road construction. While these roads could not rival canals and railroads, their role as feeder routes made them important links in the transportation system of the 1850s. Plank road construction is believed to have originated in Russia and then spread to Canada and later New York State.¹⁵⁷ Through New York's promotion, the design spread rapidly into New Jersey and along the east coast and into the midwest.

Plank roads consisted of wooden stringers embedded four or five feet apart in earth and topped by three-inch wide planks measuring eight to eleven feet long. This structure served as a wooden roadway and was flush with the ground.¹⁵⁸ The New Jersey State Highway Department's administrative history notes that plank road turnpike companies

¹⁵³Durrenberger, "Turnpikes, 87.

¹⁵⁴Peter Hugill, "Good Roads and the Automobile in the United States 1880-1929," *The Geographical Review* 72, no. 3 (July 1982): 330.

¹⁵⁵New Jersey Commissioner of Public Roads. *Fourth Annual Report of the Commissioner of Public Roads* (Trenton, NJ: MacCrellish and Quigley Co., 1898), 48.

¹⁵⁶N. S. Shaler, *American Highways: A Popular Account of Their Conditions and of the Means by Which They May Be Bettered* (New York: The Century Company, 1896), 41.

¹⁵⁷Klein, and Majewski, "Plank Road Fever in Antebellum America," 41.

¹⁵⁸Lane, *From Indian Trail to Iron Horse*, 163.

commonly used hemlock beams as stringers.¹⁵⁹ A thin layer of sand or gravel dust was sometimes applied to the surface to reduce friction and wear.¹⁶⁰ Many of these routes were laid on top of existing turnpike and public roads, so minimal grading and excavation was necessary for their construction.¹⁶¹

Most plank roads had one track, but heavily-traveled routes sometimes had two separate tracks to facilitate passing vehicles. Single tracks generally had wide, packed, earthen shoulders called summer roads that were used in good weather or by passing wagons.¹⁶² People marveled over the smoothness of these wooden roads, and cautioned teamsters not to injure their horses by driving their wagons too fast over them. Promoters of the plank road movement claimed that the boards would last between seven and twelve years, depending on their level of use, after which time past revenues would fund their replacement. In reality, the life span of the planks was little more than three years, a fact that blind-sided most of the turnpike companies. The companies could not fund the replacement of these boards, which amounted to 60 percent of the original construction cost, and many went bankrupt. According to Klein, "by 1865, the vast majority of plank roads that had been constructed had either been abandoned or connected to gravel and earth turnpikes."¹⁶³

Townships later took over the administration of many toll roads, which then became free wagon roads. In the decades that followed, however, many township supervisors neglected regular maintenance procedures crucial to the condition of gravel and earth roads. This led to a significant reduction in the quality and efficiency of the roads.

Good Roads Era (1890-1904)

Road Use

The impetus behind road improvement during this period arose from an unanticipated source. A widespread bicycle craze overtook the nation in the 1880s. Individuals with sufficient resources to purchase a new safety bicycle, which had two wheels of equal size,

¹⁵⁹New Jersey State Highway Department Bureau of Public Information, *Development of the New Jersey State Highway System*, 11.

¹⁶⁰Lane, *From Indian Trail to Iron Horse*, 163.

¹⁶¹*Ibid.*

¹⁶²Klein and Majewski, "Plank Road Fever in Antebellum America," 42.

¹⁶³*Ibid.*, 63.

and who also had ample free time, could escape congested city streets and tour the healthy, picturesque countryside. The major drawback was the overall poor condition of township roads, which had been badly neglected for the past five decades. Practitioners of this new recreational pursuit, however, did not allow this to become a stumbling block. During the next decade, cyclists proved adamant in their quest for improved rural roads. Local enthusiast chapters united nationally in 1880 as The League of American Wheelmen.¹⁶⁴ The cyclists used public education and consistent lobbying to achieve road improvements that the agricultural sector had been unable to obtain during the previous fifty years.

The wheelmen's campaign, known as the "Good Roads Movement," became widely recognized through the circulation of their journal *Good Roads*, which began publication in the 1890s.¹⁶⁵ The publication addressed advances in road improvement legislation across the country and profiled innovations in road-building techniques and materials. The movement's primary goals were to develop a network of improved roads that were not financed through tolls, to professionalize the field of road management, and to implement a system of funding that differentiated between state roads, district roads, and township roads according to their level of use.¹⁶⁶

The movement found a receptive audience and succeeded in stirring up a great deal of enthusiasm for roads at all levels. In many progressive townships, road leagues and associations organized to improve not only the actual roadway, but to create foot-paths, cycle-paths, and beautify the roadsides through tree-planting programs.¹⁶⁷ The New Jersey Shade Tree Statute officially sanctioned the latter activity in 1893. This legislation authorized municipalities to appoint a three-person committee in charge of the planting and maintenance of shade trees on the public highways within their municipal borders.¹⁶⁸ The New Jersey Commissioner of Public Roads also promoted the positive long-term effects of road improvement. His 1896 annual report recognized the following beneficial impacts, "Good Roads - Decrease taxation; Decrease living expenses; Increase property values; Increase farmer's incomes; Increase railroad business; Promote prosperity; Promote Civilization."¹⁶⁹

¹⁶⁴Rose, "The Highway From The Railroad To The Automobile," 85.

¹⁶⁵Dearing, *American Highway Policy*, 47.

¹⁶⁶*Ibid.*

¹⁶⁷New Jersey Commissioner of Public Roads, *Third Annual Report of the Commissioner of Public Roads*, 32.

¹⁶⁸"Roadside Planting," *Landscape Architecture* 26 (July 1936): 167.

¹⁶⁹New Jersey Commissioner of Public Roads, *Third Annual Report of the Commissioner of Public Roads*, 9.

It might be expected that farmers would have been vocal supporters of the Good Roads Movement. Better roads meant a more reliable, less costly means of transporting produce to market or to the nearest train line for further shipment. By the 1880s, railroads and steamboats essentially monopolized long-distance travel. Residents of urban areas and most small towns had ready access to railroad lines. Major manufacturers also had direct connections to rail and waterway systems. Farmers were the only constituency whose economic success was largely dependent on local road conditions.¹⁷⁰ Farmers, however, were initially leery of proposed improvements. Their hesitancy stemmed from the fact that during the early years of the movement, no funding base, other than local taxes, existed for these projects. Farmers did not intend to shoulder the burden of road improvement alone, preferring to stay with the status quo rather than increase their taxes. Once New Jersey initiated State Aid funding in 1891, however, the situation changed.¹⁷¹ Farmers realized that improved roads would not result in higher taxes, and they embraced the movement wholeheartedly.

Road improvements helped slow the state's declining farm values, which had begun to slide during the 1870s. By that time, railroads had developed an extensive network in the southern and midwestern states, and shipment of their produce to northern markets became a reality. Imported produce from these regions competed directly with New Jersey-grown products in New York and Philadelphia markets. In New Jersey, higher production and transportation costs rendered farmers unable to effectively compete in their former markets. This situation eventually led to a production shift from wheat and cattle to fruit, vegetables, and milk.¹⁷² By the 1890s, some people believed the New Jersey farmer's economic salvation lay not simply in changing markets, but in the development potential of their land for "rural homes and villa sites."¹⁷³ Urban residents increasingly sought out suburban retreats, and this type of development brought a financial windfall to many farmers bordering metropolitan regions.

Road improvement began to significantly alter settlement patterns in New Jersey in the 1890s. Previously, the railroads had been the lifelines of suburban development. By the 1860s, rapid transit enabled members of the upper class to live in bucolic settings like New Jersey's Llewellyn Park, while the head of the household supported this lifestyle by working in New York City. Prior to the road improvements of the 1890s, however, most

¹⁷⁰Lane, "The Early Highway in America," 75.

¹⁷¹New Jersey Commissioner of Public Roads, *Fifth Annual Report of the Commissioner of Public Roads*, 41.

¹⁷²New Jersey Commissioner of Public Roads, *Third Annual Report of the Commissioner of Public Roads*, 13.

¹⁷³*Ibid.*

suburban developments were located a mile or less from the nearest train line. Developers showed no interest in land outside this mile-wide swath, because families wanted quick, reliable access to the train lines. However, once road improvements had been completed outside this initial boundary, large stretches of the New Jersey countryside became attractive for development. According to the Public Roads Commission's 1904 annual report, prior to the good roads era "No one who commuted would dare to live more than a mile from the station. Now some enjoy country life five miles away from the railroad, and, barring an occasional blizzard, feel perfectly sure of reaching the station every day in time for their trains."¹⁷⁴

New Jersey's location between New York and Philadelphia, two major population centers, proved advantageous. People poured into New Jersey during the 1890s, increasing the state's population by thirty percent in merely a decade.¹⁷⁵ Outlying communities lobbied heavily to attract, from among the 439,000 new residents, the "better class of population" who were attracted by good roads and convenient transportation.¹⁷⁶ Savvy counties carefully planned and calculated their road construction and municipal beautification programs. These projects targeted urban residents with a penchant for nature. Tourists only needed a little encouragement to buy into the suburban lifestyle, rather than simply cycling through it on the weekends. Good roads and shaded avenues became potent lures for those seeking health and comfort without sacrificing convenience. Essex County invested heavily in road improvements during the 1890s, with the expectation that the economic advantages brought by suburban development would exceed their original investment. This approach proved quite successful, and by 1898, Essex was considered "the richest and most favored county in the state."¹⁷⁷

Good roads removed the stigma of isolation from country life, and made rural villas an increasingly attractive residential option. Rural Free Mail Delivery (RFD), initiated by the federal government in 1897, brought direct communication with the outside world to the doorsteps of many country households. Nationally, the 1.4 million mile system of postal delivery roads served 2.6 million citizens.¹⁷⁸ As townships upgraded and maintained a

¹⁷⁴New Jersey Commissioner of Public Roads, *Tenth Annual Report of the Commissioner of Public Roads* (Somerville, NJ: The Unionist Gazette Associations, 1904), 73.

¹⁷⁵New Jersey Commissioner of Public Roads, *Eleventh Annual Report of the Commissioner of Public Roads* (Paterson, NJ: News Printing, 1905), 53.

¹⁷⁶New Jersey Commissioner of Public Roads. *Fourth Annual Report of the Commissioner of Public Roads*, 48.

¹⁷⁷*Ibid.*

¹⁷⁸Dearing, *American Highway Policy*, 135.

larger system of roads, it became easier for families in the countryside to attend social functions and send their children to school regularly.¹⁷⁹ In decades past, many households found it difficult to justify placing the additional strain on the family's work-horses for what some might consider relatively frivolous endeavors. Horses needed their rest after a day behind the plow, and few farm families were willing to risk injuring their animals for mere entertainment or edification.

The good roads movement successfully lobbied for the labor and materials necessary to reclaim New Jersey's highways, which had been in a state of neglect for the better part of fifty years. Farmers were no longer slaves to the ruts and mud that separated them from markets and train lines. The rural standard of living rose; food prices decreased; and railroad freight revenues increased. Rural mail delivery and recreational facilities for touring cyclists enhanced communication between urban and rural districts. Gradually, the boundaries between urban and rural districts softened. New Jersey's picturesque countryside attracted more and more people, encouraging suburban growth.

Road Legislation and Financing

With the exception of turnpikes, which were constructed and operated using private funds, local townships were responsible for all other road construction and maintenance projects throughout the nineteenth century. A disconnected, unplanned system of local roads resulted. Road quality varied widely depending on the wealth of the township, its proximity to deposits of road building materials, and the rigorousness of the local road supervisor.¹⁸⁰ In addition, by the advent of the good roads era, only a meager number of turnpikes remained in operation. Some routes became public after the Panic of 1837 bankrupted many New Jersey Turnpike companies. Others followed in the 1860s after the collapse of the plank road boom. New Jersey congressmen spent considerable time in 1896 debating a proposal requiring counties to purchase remaining toll roads and maintain them as free roads if two-thirds of the abutting property owners signed a petition. Residents along these routes resented having to pay both tolls and local taxes to support public road construction. At that time, Camden County still retained forty miles of toll

¹⁷⁹Archer Butler Hulbert, et. al. *The Future of Road-Making In America: A Symposium*, vol. 15 in *Historic Highways of America*, 1971 Reprint (New York: AMS Press, 1902), 23.

¹⁸⁰New Jersey Commission on Road Legislation, "Report to Governor James F. Fielder by his Commission on Road Legislation," in *New Jersey* (N.p., New Jersey State Chamber of Commerce, 1916), 23.

roads, the most of any county in the State.¹⁸¹ By 1902, only three counties possessed active toll roads: Atlantic, Burlington, and Camden.¹⁸²

Control over road projects moved towards centralization in 1889 when New Jersey took the lead in national highway legislation by authorizing its counties to issue bonds for the construction of broken-stone roads. This legislation also empowered counties to assess abutting property owners for one-third the cost of those improvements.¹⁸³ Although statute labor policies prevailed across much of the nation through the turn of the century, there was a concerted effort to secure cash payments rather than labor after 1890.¹⁸⁴ In most rural areas, "Working out the road tax came to be viewed more as the occasion for neighborhood social gatherings and the exchange of the latest accumulation of stories than as a tax contribution."¹⁸⁵ This is not very surprising; however, because poor road conditions generally kept most rural neighbors from seeing each other socially. Nevertheless, the use of statute-labor did little to advance the cause of good roads.

Union County began a major road improvement program in 1889, joining Passaic and Essex Counties, who had already established good roads policies during the preceding decade.¹⁸⁶ The success of these programs encouraged the New Jersey State Legislature to continue their progressive course of action with regards to road construction. In 1891, New Jersey passed the landmark State Aid Act and became the first state to officially recognize its responsibility for road improvements. Regionally, New York and Maryland instituted similar policies in 1898, followed by Pennsylvania and Delaware in 1903.¹⁸⁷ With the passage of the State Aid Act, township residents could petition their county Board of Chosen Freeholders for road funds. If the county board and the commissioner of public roads both approved the petition, the state agreed to pay one-third the cost of the requested improvements.¹⁸⁸ Of the remaining seventy percent of the expenses, abutting property

¹⁸¹New Jersey Commissioner of Public Roads, *Second Annual Report of the Commissioner of Public Roads* (Trenton, NJ: MacCrellish and Quigley, 1896), 18.

¹⁸²New Jersey Commissioner of Public Roads. *The Ninth Annual Report of the Commissioner of Public Roads* (Trenton, NJ: John L. Murphy Publishing, 1902), 69.

¹⁸³Spencer Miller, Jr., "History of the Modern Highway System in the United States," in *Highways in Our National Life: A Symposium*, edited by Jean Labatut and Wheaton J. Lane (Princeton, NJ: Princeton University Press, 1950), 90.

¹⁸⁴Thomas MacDonald, "How Highway Financing Has Evolved," *Engineering New Record* 104, no. 1 (January 2, 1930): 4.

¹⁸⁵Dearing, *American Highway Policy*, 43.

¹⁸⁶E. C. Hutchinson, "The Good Roads Movement in New Jersey," *Good Roads Magazine* 8 (April 1907): 109.

¹⁸⁷Norman Hebden and Wilbur S. Smith, *State-City Relationships in Highway Affairs* (New Haven, CT: Yale University Press, 1950), 26.

¹⁸⁸"The Highway System of New Jersey," *Good Roads* 11 (April 1910): 122.

owners paid ten percent, and the county paid sixty percent.¹⁸⁹ The county was also required to hire a professional engineer to monitor and supervise maintenance of the route, thereby assuring a basic level of quality control for roads throughout the state.¹⁹⁰

The state aid program shifted the financial burden for major road improvements from municipalities to the county and state levels of government. Townships had found it extremely difficult to pull together financing for major road projects, but an infusion of funding from county and state sources triggered a wave of activity at the local level. The first road in the United States to be constructed under a state aid program was a ten mile section of macadam road in Middlesex County, New Jersey.¹⁹¹ During the first decade after the legislation was passed, a large number of municipalities in the northern and coastal regions of the state took advantage of the program with the goal of connecting major cities like Paterson, Morristown, the Oranges, Elizabeth, the Amboys, and Trenton, as well as to provide a clear route to summer resorts like Atlantic City, Lakewood, and Cape May.¹⁹²

The program was a tremendous success and "stimulated the property-holders of many counties in New Jersey to spend hundreds of thousands of dollars upon their roads to meet the State appropriation."¹⁹³ Its popularity was due, in large part, to the fact that the county only initiated improvements upon the petition of those who stood to benefit directly from their execution. The sole obligation of the petitioners was to pay ten percent of the cost, a relatively small amount when compared with the long-term economic benefits.¹⁹⁴ Five years after its adoption, as more counties decided to take advantage of the program, requests for state aid funds exceeded the available appropriation.¹⁹⁵ Nevertheless, between 1891 and 1900, counties throughout New Jersey constructed a total 1,500 miles of new, improved roadways.¹⁹⁶ Even after other states began similar programs, the level of New Jersey's appropriations continued to dwarf all others. In 1904, New Jersey administered \$2,000,000 in road funds, while the combined appropriations of the other twelve states with similar programs totaled merely \$607,000.

¹⁸⁹Harwood Frost, *The Art of Roadmaking: Treating of the Various Problems And Operations In the Construction And Maintenance of Roads and Pavements* (New York: Engineering News Publishing, 1910), 257, 267.

¹⁹⁰John B. Rae, *The Road and Car in American Life*, 32.

¹⁹¹"The Highway System of New Jersey," *Good Roads* 11 (April 1910): 122.

¹⁹²New Jersey Commissioner of Public Roads, *Ninth Annual Report of the Commissioner of Public Roads*, 92.

¹⁹³New Jersey Commissioner of Public Roads, *Third Annual Report of the Commissioner of Public Roads*, 8.

¹⁹⁴New Jersey Commissioner of Public Roads, *Fourth Annual Report of the Commissioner of Public Roads*, 47.

¹⁹⁵New Jersey Commissioner of Public Roads, *Third Annual Report of the Commissioner of Public Roads*, 9.

¹⁹⁶"The Highway System of New Jersey," *Good Roads* 11 (April 1910): 122.

The federal government did not provide general assistance for road construction during this era; however, it did support peripheral programs related to the good roads movement. The federal government established the Office of Road Inquiry in 1893 to disseminate educational information about road improvement.¹⁹⁷ One of its most successful programs involved the construction of "object-lesson roads" in locations throughout the country. The organization worked cooperatively with the nation's agricultural colleges to develop and implement the program. Municipalities provided the required materials and labor, the Office of Road Inquiry contributed professional road-building expertise, and the end result was a model road that would guide future construction projects in the area. One of the first of these roads was constructed at the New Jersey Agricultural College and Experiment Station in 1897.¹⁹⁸ The Office of Road Inquiry, later known as the Office of Public Roads, also conducted research on road building materials in the United States to determine their various strengths and weaknesses. The scope of this research later broadened to include analysis and development of road preservatives.¹⁹⁹

Road Construction

The development of a quality road system was a low priority for most municipalities prior to the 1890s. Little money was spent in that area, therefore advancements in the field of road construction were limited. The research needed to develop proper materials and design did not gain financial support until the 1890s, when money for road improvements began to flow more freely. Americans lagged substantially behind Europeans in road innovations during the early part of the century. According to Charles Dearing's history of American highway policy, "By comparison with European standards, the American system of road administration was obsolete and the quality of roads strikingly inferior."²⁰⁰ When compared to roads in other regions, those in the Mid-Atlantic and New England states were still considered far superior to the road systems in the South and Midwest.²⁰¹

By the 1870's a few localities began experimenting with new types of paving systems other than earth or crushed stone. Vitrified brick was first used for paving a section of road in Charleston, West Virginia in 1870 and was then adopted as a common paving material in

¹⁹⁷Holt, *The Bureau of Public Roads*, 1.

¹⁹⁸*Ibid.*, 8.

¹⁹⁹*Ibid.*, 11.

²⁰⁰Dearing, *American Highway Policy*, 44.

²⁰¹James J. Flink, *America Adopts the Automobile 1895-1910* (Cambridge, MA: MIT Press, 1970), 202.

certain sections of the midwest with extensive clay deposits.²⁰² Newark, New Jersey saw the first installation of asphalt pavement in the United States the same year.²⁰³ Around the same time, Portland Cement went into production in the United States, thereby eliminating the need to import the material.²⁰⁴ By 1893, technological advancements, including the 1877 invention of the steam-powered mortar mixer, led to the first use of concrete pavement in Bellefontaine, Ohio.²⁰⁵ Although not widely adopted for two more decades, concrete paving proved to be a viable solution to pavement deterioration caused by the introduction of automobile and motor truck traffic. Cities often used stone paving blocks in urban areas subject to heavy traffic and excessive loads. Granite was the most popular material, but sandstone and duxex, a composite, artificial stone, cubical in shape, were also used to a lesser extent.²⁰⁶ Creosote-treated wood block was also used as a paving material during this era. While not long-lasting, wood blocks were inexpensive and served well in fast-growing cities where roads were quickly upgraded.²⁰⁷

Gravel pavements dominated the road improvement field until the widespread introduction of the automobile in 1904.²⁰⁸ According to road historian Spencer Miller, before 1904 "improved roads of a higher type than water-bound macadam were so few that they were in effect only experimental."²⁰⁹ This pavement type proved satisfactory for the relatively light wagon and carriage traffic that had been characteristic of the first half of the century. As traffic volume increased and growing numbers of people began touring the countryside, a significant problem appeared. Passing traffic continually stirred up the dust that served as the binder between stones in the roadbed. These dust clouds not only created a nuisance for travelers and adjacent property owners, but also resulted in structural destabilization of the road's surface. In 1898, Los Angeles began an experimental program involving the application of a thin layer of crude oil to the road surface to inhibit the creation of dust.²¹⁰ New Jersey adopted this program shortly thereafter. Other applications used in dust

²⁰²Charles E. Morrison, *Highway Engineering* (New York: John Wiley and Sons, 1908), 194.

²⁰³ United States Department of Transportation, *A Nation in Motion: Historic American Transportation Sites* (Washington, DC: U.S. Government Printing Office, 1976), 50.

²⁰⁴Albert C. Rose, "The Highway from the Railroad to the Automobile," 84.

²⁰⁵Arthur C. Bruce and John Clarkeson, *Highway Design and Construction*, 3rd Edition (Scranton, PA: International Textbook, 1950), 467.

²⁰⁶Bateman, *Introduction to Highway Engineering*, 411.

²⁰⁷Frost, *The Art of Roadmaking*, 335.

²⁰⁸Charles M. Upham, "The Last Two Decades in Highway Design, Construction, and Maintenance." *The American City* 43 (September 1930): 90.

²⁰⁹Miller, "History of the Modern Highway in the United States," 101.

²¹⁰Morrison, *Highway Engineering*, 144.

prevention included the application of salt water, a mixture of water and calcium chloride, and other diluted coal-tar products.²¹¹

Although researchers conducted numerous experiments with paving surfaces during the Good Roads Era, new approaches to structural composition or alignment garnered little attention. Through the first decade of the twentieth century, road improvement projects rarely called for altering an existing alignment. The initial investment in clearing and grading a roadway was too great to dismiss casually, so existing routes, despite their somewhat circuitous nature, remained intact.²¹² Two general construction methods were used at this date: surface construction, in which workers applied a surface material on an untreated roadbed, and trench construction, which involved properly excavating the roadbed before applying the paving material.²¹³ Obviously the latter option, while necessitating a larger initial investment in preparation, outlasted the former.

County engineers in charge of construction and maintenance often had prior experience working on railroad lines, and they transferred much of their former experience to the road management field. Realizing that proper drainage was critical to the long-term survival of roads, engineers specified that counties construct roadbeds on raised embankments flanked by deep side ditches to carry storm runoff. Also required were culverts, which allowed water to pass underneath the roadway without undermining its foundation. The most stable culverts had a headwall and wingwalls surrounding the pipe to reduce erosion and stabilize the embankment. Many different types of materials were used for culvert construction including, stone, which was very expensive and rather rare, vitrified clay pipe, and cast iron pipe.²¹⁴ The ubiquitous corrugated metal pipe culvert, which has become a fundamental element in the American landscape, was invented in 1896 by two men from Indiana.²¹⁵

The roadbeds constructed during this era had high crowns and were similar in profile to the old turnpike roads, which were high in the center and tapered gradually down to the shoulders.²¹⁶ Most rural roads consisted of only one lane with an eight-foot wide gravel

²¹¹Frost, *The Art of Roadmaking*, 225.

²¹²Henry B. Drowne, "The Relation Between Modern Traffic and the Alignment and Profile in Highway Design," *Good Roads* 1 (1911): 115.

²¹³Morrison, *Highway Engineering*, 50.

²¹⁴Bateman, *Introduction to Highway Engineering*, 59-61.

²¹⁵Thomas J. Schlereth, *U.S. 40: A Roadscape of the American Experience* (Indianapolis: Indiana Historical Society, 1985), 29.

²¹⁶Joseph Austin Durrenberger, "Turnpikes: A Study of the Toll Road Movement in the Middle Atlantic States and Maryland," diss., Columbia University, 1931, 86.

or stone surface. Vehicles had to pull off onto the shoulders in order to pass. Engineers recommended that in certain cases, where traffic volume required vehicles to pass frequently, a sixteen-foot roadway width could be used.²¹⁷

Hired labor completed most of the roadwork after 1891. New Jersey gradually eliminated statute labor and provided funding to hire professional road workers. The roads at that time were better maintained than those earlier in the century, because the state required counties to keep their improved roads at a certain standard in order to qualify for additional funds. In spite of the state's apparent generosity, counties submitted more requests than could be met by the appropriation. Instead of rejecting large numbers of these requests in order to allocate a large block of funding for a project of statewide merit, the government divided up the money into numerous small portions. As a result, many counties participated in the state aid program, but their projects were very small, sometimes only one mile in length. There was no effort to utilize the funds to develop a centralized state road system at that time.

It is unlikely that there are many stretches of early state aid roads remaining in New Jersey that still retain their pre-1900 features. Population growth and increasing transportation needs precipitated most of the initial improvements to these roads. The majority of state aid roads likely succumbed to additional, character-altering improvements during the twentieth century as a result of continuing development pressure. In the event, however, that a survivor of this type is found, the following roadway features should be given consideration: the alignment; the cross section, including grading in the right-of-way, the embankment, and elements of the drainage system; as well as the construction materials for the foundation and the paving surface. Location of related roadway features holds more promise than the identification of actual roadway elements. Roadside features of this era would generally have predated the instigation of road improvements, since the primary objective of the good roads movement was to "get the farmer out of the mud" rather than spur new development. Therefore, a survey of existing roadside elements dating to this era is required with an analysis of how road construction or improvements would have impacted those elements. These features might include structures like mile posts or water troughs, or buildings like commercial enterprises, residential developments, farms, schools, churches, railroad stations, or whole main streets. The Commissioner of Public Roads annual reports for this time period provide a survey of current road projects, their locations, progress, and anticipated impact on the locality.

²¹⁷New Jersey Commissioner of Public Roads, *Fifth Annual Report of the Commissioner of Public Roads*, 39.

Advent of the Automobile Era (1904-1917)

Road Use

Although George B. Selden received a patent for a gas-driven automobile as early as 1879, it took another twenty-five years for the motor car to become a noticeable presence in the American countryside.²¹⁸ By 1904, the car overcame the confines of the city and made its way out into the rural districts of New Jersey²¹⁹ However, not until 1909, when Henry Ford's Model-T went into production, did car ownership shift from being an upper-class novelty to being an attainable goal for most income brackets.²²⁰ Time payments were introduced in 1912, thereby enabling a person with limited cash flow to purchase a car with a deposit of half the price and an agreement to pay the remaining half in one or two installments.²²¹

Statistics indicate that New Jersey residents eagerly adopted this new form of transportation. A 1913 survey revealed that New Jersey had a higher percentage of vehicles per mile of road than most other states in the region including, New York, Massachusetts, Maryland, and Connecticut.²²² The state completed 650 miles of new roads the same year, which represented a 40 percent increase over the previous year.²²³ Nevertheless, the state's traffic density continued to place increasing demands on existing roads. The transportation industry reached a major turning point in 1914 when automobile production finally surpassed the manufacture of carriages and wagons.²²⁴ Car ownership was on the upswing, and by 1916, there was one car for every thirty-two New Jersey residents and six cars for every mile of improved road.²²⁵

Road improvements combined with car affordability to give Americans the freedom of the open road. Free of train schedules and fixed timetables, people could follow any passable

²¹⁸Rose, "The Highway from the Railroad to the Automobile," 84.

²¹⁹Bateman, *Introduction to Highway Engineering*, 3.

²²⁰Hugill, "Good Roads and the Automobile in the United States 1880-1929," 327.

²²¹Tyler Poyntz, ed., *American Highways Today*, vol 29 in *The Reference Shelf* (New York: H. W. Wilson Company, 1957), 43.

²²²New Jersey Commissioner of Public Roads, *Twentieth Annual Report of the Commissioner of Public Roads* (Trenton, NJ: MacCrellish and Quigley, 1913), 93.

²²³"Reports of Road Construction in New Jersey," *Good Roads* 6 (December 20, 1913): 405.

²²⁴Rae, *The Road and Car in American Life*, 57.

²²⁵"Governor Fielder's Recommendations for the Work of Highway Improvement in New Jersey," *Good Roads* 11 (February 5, 1916): 68.

route as far as it would take them. Weekend trips and country drives gave many middle class Americans an opportunity for leisure travel that they could not have experienced without a car. During much of the nineteenth century, the majority of tourists were members of the upper class with resources and time to spend an entire season in a resort location. The arrival of the automobile; however, placed tourism within the realm of the middle class through the introduction of weekend travel.

This development gave an added boost to resorts along the New Jersey shore. Ocean-side communities drew on the populous metropolitan regions surrounding New York and Philadelphia to expand their visitor base. During the late 1890s the state endeavored to create a limited number of "continuous lines," cross-state east-west and north south routes. One of the first major north-south routes linked Jersey City with Atlantic City.²²⁶ Other shore-related road construction projects included smaller "meadow roads." Shore counties built these causeways over tidal marshes to connect resort towns on barrier islands, like Ocean City, with mainland travel routes.²²⁷ "Meadow roads" often utilized oyster-shells as a paving material, because it was locally available and possessed natural cementing qualities.²²⁸ The New Jersey State Legislature recognized the tremendous economic potential of shore-related tourism, and in 1910, appointed a special commission to determine the feasibility of constructing an "ocean boulevard" between Cape May and Atlantic City.²²⁹ The chambers of commerce for a large group of sea-shore cities devised a plan in 1915 to raise \$800,000 in order to build a series of bridges to link New Jersey's coastal islands, creating a forty-mile route from Cape May to Atlantic City. Bridge construction was not eligible for state aid funding at that time, and all such projects had to be financed independently of related roadway improvements.²³⁰

The state deemed the plan for the ocean boulevard very promising. Eventually, it became a cornerstone of New Jersey's 1912 plan for a 1,500 mile state-wide system of roads that would also connect county seats and create a drive along the Delaware River.²³¹ The shore, however, was not the motorist's only destination. Those on a limited schedule or

²²⁶New Jersey Commissioner of Public Roads, *Fifth Annual Report of the Commissioner of Public Roads*, 40.

²²⁷New Jersey Commissioner of Public Roads, *Eleventh Annual Report of the commissioner of Public Roads*, 49.

²²⁸New Jersey Commissioner of Public Roads, *Thirteenth Annual Report of the Commissioner of Public Roads* (Trenton, NJ: MacCrellish and Quigley, 1907), 57.

²²⁹"Extension of the New Jersey Road System," *Good Roads* 11 (January 1910): 34.

²³⁰"System of Bridges Planned to Connect New Jersey Resorts," *Good Roads* 10, no. 17 (October 30, 1915): 239.

²³¹"Highway Legislation in New Jersey," *Good Roads* 3 (February 17, 1912): 101; "New State Laws Proposed for New Jersey," *Good Roads* 3 (January 6, 1912): 17.

budget could escape the city for a short country jaunt. As more people took to the scenic byways, roadside taverns saw a revival. In 1913, New Jersey's Commissioner of Public Roads observed that "since the advent of the railroad, our highways have never been so generally and continuously used as they are today. One of the most noticeable evidences of this is that the old inns and taverns that had fallen into disuse are being remodeled and once more are centers of activity."²³² The adventure of motoring in an open touring car was then considered a valuable form of exercise, "The outdoor life of the present day, brought about largely by the automobile, has had a more wholesome effect on the people than perhaps any other measure."²³³

The year 1904 witnessed the introduction of the motor truck, whose presence was made known by the crumbling pavements and billowing clouds of dust that trailed behind them.²³⁴ The truck was a boon for farmers seeking to further reduce shipping costs for their produce. Those who could not afford to own their own truck could procure the services of a delivery service at a cheaper rate than prevailing railroad freight fees. In addition, the bonus of direct delivery eliminated early morning trips to the rail depot. Instead, transportation came directly to the farmer's home. Better off still were the farmers who could afford the down payment for their own truck. This purchase, while a major investment, allowed them increased shipping flexibility and a greater consistency in transportation costs.

Delivery trucks also became a common site within cities, as merchandisers realized that trucks were more cost effective than trains for short-distance hauls. Governor Fielder, in his 1916 recommendations for New Jersey road improvements, acknowledged that, while railroad and water transportation had dominated the previous decade, the use of trucks for freight shipment was a factor that now needed to be addressed.²³⁵ Short-distance trips between outlying rural districts and mid-size towns became the characteristic usage pattern of that time. Consequently, road improvements reflected those needs, resulting in a network of improved, short, radial routes emanating from each county's population center. Some of the major transportation hubs included: Camden, Trenton, Newark, and

²³²New Jersey Commissioner of Public Roads, *Nineteenth Annual Report of the Commissioner of Public Roads* (Trenton, NJ: State Gazette Publishing, 1913), 65.

²³³George R. Chatburn, *Highways and Highway Transportation* (New York: Thomas Y. Crowell Company, 1923), 211.

²³⁴Miller, "History of the Modern Highway in the United States," 95.

²³⁵"Governor Fielder's Recommendations for the Work of Highway Improvement in New Jersey," *Good Roads* 11 (February 5, 1916): 68.

Morristown.²³⁶ Only a limited number of long-distance routes were improved along their entire length, which limited the economic benefits of inter-regional shipments.

America's entrance into World War I further increased the motor truck's role in freight delivery. Legions of trucks crossed through New Jersey on their way to the ports of New York, where congestion had brought rail transportation to a virtual standstill.²³⁷ General Goethals, New Jersey's State Road Engineer, noted in 1917 that, "The present and prospective war conditions affecting the handling of freight by the railroads will result in the greater use of motor trucks as well as tend to increase the loads hauled by them."²³⁸ Trucks possessed greater flexibility of movement than trains. Military supply utilized trucks extensively to ferry provisions from railroad depots to the docks. War-time requirements vaulted the humble delivery truck to a position of national prominence, and long-distance hauling took precedence over local deliveries.²³⁹ This shift in patterns of road use later required a new approach to funding allocations for improvements suitable for intense truck traffic. During the war, however, restrictions on materials and labor severely limited new construction projects. This forced drivers to utilize the state's existing road system, which had been developed for short-distance travel rather than regional transportation. By 1917, congressmen no longer saw New Jersey's highways solely as an economic asset, they became a defensive, military resource, the gateway to the Port of New York, the country's largest shipping outlet.²⁴⁰

In 1918, General George Goethals, the state's newly appointed State Highway Engineer, set out an approach for addressing transportation needs during the war. Legislation creating the New Jersey State Highway System had been passed the previous year, and Goethals' challenge was to distribute the limited funds, material, and labor that were available to him in the most effective way. Goethals decided to target the legislated trunk-line routes that were key to wartime activities.²⁴¹ The following are selected roads from Goethals' list of priority routes:²⁴²

²³⁶New Jersey Commissioner of Public Roads, *Fifth Annual Report of the Commissioner of Public Roads*, 40.

²³⁷"Continued Activity in New Jersey Road Work Recommended by General Goethals," *Good Roads* 17 (December 29, 1917): 336.

²³⁸*Ibid.*

²³⁹William A. Bresnahan, "Freight Transportation on the Highway," in *Highways in Our National Life: A Symposium*, edited by Jean Labatut and Wheaton J. Lane (Princeton, NJ: Princeton University Press, 1950), 247.

²⁴⁰"Continued Activity in New Jersey Road Work Recommended by General Goethals," *Good Roads* 17: 336.

²⁴¹"New Jersey's 1918 Road Program: State Highway Commission Adopts General Goethals' Plan for War-Time Road Improvement," *Good Roads* 15 (January 26, 1918): 42.

²⁴²The highway route numbers used in 1918 do not necessarily represent present route numbers.

1. Route No. 1 - Important for establishing a connection between Trenton, the industrial cities of North Jersey, and the Port of New York.
2. Route No. 4 - Important for carrying short-haul industrial traffic to the Raritan River Bay.
3. Route No. 6 - Important for linking the agricultural areas of South Jersey to the cities of Camden and Philadelphia.
4. Route No. 9 - Important route for steel shipment from Bethlehem through the manufacturing region of North Jersey to Elizabeth.
5. Route No. 10 - The most heavily traveled route in New Jersey at the time. Connected the Passaic Valley with the Hudson River Ferries.
6. Route No. 14 - Important as the only road outlet for the Cape May Naval Station.

These excerpts clearly indicate some of the significant highways during the war, while also revealing general road functions in New Jersey during this period. The list shows a wide range of uses including transportation of agricultural produce, raw materials, finished manufactured products, and troops. Recreational travel and commuting are understandably absent from this list, but were still significant road uses prior to 1917 and again after the war. It is important to realize that different periods in history, like World War I, had different transportation requirements that should be taken into account when evaluating a specific route for historic significance.

Gains in the standard of living in rural areas that were made during the Good Roads Era, continued at a faster pace after the introduction of the automobile. As mentioned above, the use of trucks for shipping produce reduced operating costs for farmers, thereby increasing their profit margin. These additional profits could be readily spent during shopping trips to nearby towns, which were made more accessible by the family truck. These expenditures resulted in increased retail sales and local economic growth. Country doctors switching from horse-drawn carriages to cars accounted for a large number of automobile purchases. House calls were made relatively effortless, thereby improving rural medical care. In a sense, automobiles brought people closer to one another, reducing feelings of isolation and improving general communication, as well as police and fire protection.²⁴³

Suburban development increased at an even more rapid pace than during the previous decade. Civic leaders touted investments in road improvement as the fast track to increased property values. In 1910, E. C. Hutchinson, New Jersey's Commissioner of Public

²⁴³Bruce and Clarkeson, *Highway Design and Construction*, 4.

Roads, commented that, "State Aid has done more for our State than any law ever placed upon the statute books. It has increased the value of our farms and has added to the pleasure and comfort not only of our farmers, but to that of the city men who have bought farms and built large country mansions along the line of our improved roads, thus increasing our ratables by millions of dollars."²⁴⁴ Gradually, a combination of improved roads and easy automobile access allowed upscale residential development to supplant previous agricultural uses throughout New York City's sphere of influence.

Road Legislation and Financing

As pleasure traffic and freight truck hauling increased during the first decade of the automobile era, the New Jersey State Legislature realized that the existing pool of state aid funds had to be supplemented in order to maintain roadways at their improved level, while continuing a program of new construction. Vehicle license and inspection fees accounted for a minimal portion of this funding increase. New Jersey began perennial automobile registration as early as 1903, and required annual registration in 1906.²⁴⁵ Revenues from vehicle license fees were extended to the repair of improved highways in 1906 as well.²⁴⁶

Unfortunately, due to the fact that macadam pavements without additional binders were better suited to the light carriage traffic of the 1890s than the heavy automobile traffic present after the turn of the century, maintenance costs far exceeded fee levels assigned to automobile users. In 1916, studies estimated that a car traveling an average of six-hundred miles a year imposed thirty-five dollars in maintenance costs, while only paying seven dollars and fifty cents in annual fees.²⁴⁷ In addition, maintenance projects were not as satisfying as improving entirely new segments of road, so funds continued to be funneled into new construction at the expense of the long-term quality of the entire road system. The 1916 annual report of the New Jersey Commissioner of Public Roads addressed this problem stating, "Today, however, the preservation of our roads has become the matter of paramount importance. Until, by satisfactory methods of maintenance, we have provided

²⁴⁴Hutchinson, "The Good Roads Movement in New Jersey," 109.

²⁴⁵Flink, *America Adopts the Automobile 1895-1910*, 167.

²⁴⁶New Jersey Commission on Road Legislation, "Report to Governor James Fielder by His Commission on Road Legislation," *New Jersey* 4, 23.

²⁴⁷"Governor Fielder's Recommendations for the Work of Highway Improvement in New Jersey," *Good Roads* 11 (February 5, 1916): 68.

for the conservation of our present great investment, it seems unwise to increase the amount at risk and add to the size and difficulties of the task."²⁴⁸

Bridges and culverts were another key component of the state's highway system. A highway route was only as good as its weakest link, and the limited weight capacity of bridges along an improved road reduced its economic efficiency dramatically. Until 1912, however, state aid could not be applied towards bridge construction, these funds were confined to actual roadway improvements.²⁴⁹ Therefore, municipalities and counties were left to bear the burden of bridge construction and enhancement alone. This became a growing problem, especially due to the fact that increased traffic volume required larger, costlier structures of heavier construction than wagon and carriage-era bridges. In addition, lack of professional expertise led county bridge engineers to design simple structures that crossed stream beds at right angles, rather than utilizing skewed designs, so that the approaches would correspond with the roadway alignments.²⁵⁰ This situation was later recognized as a major safety hazard, especially for night driving. Poorly designed bridge approaches could also be very steep, resulting in reduced hauling capacity. Also, steepness, when combined with a tight curve at the top of the approach, was a recipe for disaster. Many trucks tipped over and lost their loads when attempting to maneuver across one of these locally financed and constructed bridges.²⁵¹

Finally, in 1913 New Jersey applied state aid funds to bridges in a limited way, and eventually the state took responsibility for bridge construction on state highways.²⁵² Bridge capacity, condition, and maintenance became even more critical during the war. The highway department was encouraged to plan ahead and anticipate increased loads.²⁵³ In the three years leading up to World War I, the State Highway Department constructed twenty-five bridges ranging from the most basic creosoted timber trestle, to Straus Bascule bridges, and reinforced concrete box culverts. New Jersey also passed legislation giving townships additional support in 1916, when they amended the state aid legislation, so that

²⁴⁸New Jersey Commissioner of Public Roads, *Twenty-Third Annual Report of the Commissioner of Public Roads* (Trenton, NJ: MacCrellish and Quigley, 1916), 57.

²⁴⁹"New State Laws Proposed For New Jersey," *Good Roads* 3 (January 6, 1912): 17.

²⁵⁰W. A. Bugge and W. Brewster Snow, "The Complete Highway," in *The Highway and The Landscape*, edited by W. Brewster Snow (New Brunswick, NJ: Rutgers University Press, 1959), 6.

²⁵¹New Jersey Commissioner of Public Roads, *Eighteenth Annual Report of the Commissioner of Public Roads* (Trenton, NJ: State Gazette, 1912), 60 and 66.

²⁵²New Jersey Commission on Road Legislation, "Report to Governor James Fielder by His Commission on Road Legislation," *New Jersey* 4, 23.

²⁵³New Jersey Commissioner of Public Roads, *Twenty-Second Annual Report of the Commissioner of Public roads* (Trenton, NJ: MacCrellish and Quigley, 1915), 80.

the funds could be applied to township roads. The state matched local funding, providing up to 50 percent of the improvement costs and also agreed to conduct the necessary surveys and develop plans.²⁵⁴

The federal government's Post Office Appropriation Act of 1912, which allocated \$500,000 nationally for the improvement of post roads, had only minimal impact on New Jersey once the funding was divided among the states.²⁵⁵ The passage of this act was, however, a portentous signal revealing the federal government's interest in moving beyond the public education side of road improvement to take a more active role in actual construction projects. Four years later, in 1916, President Wilson signed the Federal Road Aid Act, thereby making the federal government the major player in highway construction from that time up to the present. Administration of federal aid funds became the primary activity of the Office of Road Inquiry, which was later renamed the Bureau of Public Roads in 1923, and the Public Roads Administration in 1939.²⁵⁶

The 1916 Federal Aid Road Act appropriated the sizable sum of \$75 million to be spent over five years on the improvement of the nation's post roads, with a supplement of \$10 million to be spent over a ten-year period. In order to receive funding, each state had to establish a state highway department. The federal government did impose restrictions on the types of road projects that could be funded. Each state was free to decide where to put their share of the funding. The federal government provided funding for 50 percent of the construction costs, which then had to be matched by the state.²⁵⁷ According to one report, this federal legislation was based, in part, on New Jersey's State Aid Act.²⁵⁸ Between World War I and World War II, the funding provided by the Federal Roads Aid Act, resulted in the construction of 1,384,000 miles of surfaced rural roads throughout the United States.²⁵⁹ Federal aid also established a framework for future highway development that would take place after the war by: setting classifications for traffic density; requiring that a highway system be designated in all states; promoting the idea of

²⁵⁴"State Road Work Done in New Jersey During the Past Year," *Good Roads* 13 (March 17, 1917): 173.

²⁵⁵Rose, "The Highway from the Railroad to the Automobile," 87.

²⁵⁶Bruce and Clarkeson, *Highway Design and Construction*, 15.

²⁵⁷United States Department of Transportation, *A Nation in Motion*, 123.

²⁵⁸New Jersey Commission on Road Legislation, "Report to Governor James F. Fielder by his Commission on Road Legislation," *New Jersey* 4, 23.

²⁵⁹Rose, "The Highway from the Railroad to the Automobile," 87.

phased improvements; encouraging adequate maintenance standards; and supporting the scientific study of materials and traffic patterns.²⁶⁰

New Jersey established a State Highway Commission in 1909, eight years prior to the institution of the Federal Road Aid Act's requirement. As a result of the legislation, the Commission changed its name to the New Jersey State Highway Department in 1917.²⁶¹ One of the Commission's first tasks entailed designating the route for the ocean boulevard from the Atlantic Highlands to Cape May.²⁶² In 1912, the New Jersey State Legislature assigned the Highway Commission the task of surveying existing improved routes and developing a comprehensive system of roads that would be known as the New Jersey State Highway System.²⁶³ Identification of a system of state roads had true importance at that time, because road construction had continued to become more and more decentralized during the twenty-years after the passage of the New Jersey State-Aid Act. Prior to 1917, the following entities administered the state's road work programs: townships managed 12,380 miles; cities managed 2,500 miles; counties managed 2,400 miles; boroughs managed 2,100 miles; towns managed 850 miles; villages managed 89 miles; and toll companies still managed 38 miles.²⁶⁴ Identification of and preferential funding treatment for trunk lines became critical to the state's economic growth, due to the growth of cross-state traffic that arose from increased use of trucks for long-distance hauling.

The Commission developed a plan for a 1,350-mile road system that included both existing routes as well as proposed new construction. The plan also recognized three different classes of roads: the State Highway, the county road, and the municipal road. In addition to the ocean boulevard and Delaware River drive, a network of highways connecting county seats and other routes of state-wide importance was also proposed.²⁶⁵ In 1913, the Legislature authorized the State Highway Commission to take over, with the consent of the governing bodies having jurisdiction over them, 500 miles of existing roads that were to be incorporated as part of the 1,350-mile highway system. The state also took responsibility

²⁶⁰Thomas H. MacDonald and H. S. Fairbank, "The Development of Improved Highways," *Roads and Streets* 66, no. 2 (August 1926): 76.

²⁶¹New Jersey State Highway Department, *Development of the New Jersey State Highway System*, 13.

²⁶²New Jersey Commission on Road Legislation, "Report to Governor James F. Fielder by his Commission on Road Legislation," *New Jersey* 4, 23.

²⁶³New Jersey State Highway Department, *Development of the New Jersey State Highway System*, 12.

²⁶⁴The Commission for the Investigation of County and Township Highways, "The Administration of County and Township Highway in New Jersey," (Unpublished Report New Jersey State Library), 1919, 4.

²⁶⁵New Jersey Commission on Road Legislation, "Report to Governor James F. Fielder by His Commission on Road Legislation," *New Jersey* 4, 23.

for maintenance and repairs.²⁶⁶ The 1912 system never made substantial progress, however, because the Highway Commission was required to procure consent from multitudinous municipal agencies before taking over a section of road. In addition, the Commissioner never obtained sufficient funding to actually take over and improve routes.²⁶⁷ In 1917, improved legislation endowed the Commission, now reorganized as the New Jersey Highway Department, with greater power and the funding necessary to take over existing roads and lay out new highways.²⁶⁸ The 1917 road legislation identified the fifteen New Jersey State Routes that were to become the foundation for today's state highway system.²⁶⁹

In order to qualify for federal aid, New Jersey still had to raise large blocks of matching funds. The need was critical, and traffic volume continued to increase at a rapid pace. Edwin Stevens, New Jersey Commissioner of Public Roads in 1915, estimated that at least \$51,300,000 was required to put the state's highways in good condition.²⁷⁰ Although raising that entire amount was highly improbable, since it amounted to two-thirds of the entire national allotment, it was still crucial that New Jersey not fall behind in either new construction or repair. Although 9,100 miles of the state's roads had been improved by 1914, only 1,500 miles, or 16 percent, were usable year round. In addition, there were still 5,174 mile of unimproved highways (trails) and 6,123 miles of graded earthen highways that had not yet been modernized in any way.²⁷¹

As mentioned previously, the combination of state appropriations and automobile user fees proved inadequate to meet this need. The Edge Bill, passed by the Legislature in 1917, did, however, plug a significant segment of that funding gap. The Edge Bill instituted a 1-mil tax on all real and personal property in the state, and legislators expected it to raise \$15,000,000 for highway construction over the course of five years.²⁷² New Jersey established a State Road Fund at this date. The fund held proceeds from the property tax, as well as from state appropriations, license fees and fines, federal aid, sales of condemned

²⁶⁶Ibid., 24.

²⁶⁷Ibid.

²⁶⁸New Jersey State Highway Department Bureau of Public Relations, *Development of the State Highway System*, 13.

²⁶⁹*Twenty-Fourth Annual Report of the New Jersey State Highway Department* (Union Hill, NJ: Hudson Printing, 1918), 87.

²⁷⁰"Report States that \$51,000,000 Is Needed for New Jersey Roads," *Good Roads* 10 (November 27, 1915): 284.

²⁷¹"The Commission for the Investigation of County and Township Highways," 3.

²⁷²"Fifteen Million Dollar Road Bill Pass in New Jersey," *Good Roads* 13 (March 17, 1917): 178.

property, and fines, penalties, or damages for violation of road laws.²⁷³ The fund supported all of New Jersey's highway construction and maintenance programs as well as providing the salary for the highway department.

The Edge Bill also established the position of Consulting Engineer to the Highway Department, a position filled by General George Goethals, famed for his leadership in the construction of the Panama Canal. Goethals succeeded R. A. Meeker, who served as the New Jersey State Highway Engineer and played an instrumental role in establishing New Jersey's reputation as a progressive state in the field of road improvement.²⁷⁴ Goethals took an aggressive stance in regards to the state's road program. Despite wartime conditions, he rallied the railroad companies to begin participating in the 1917 legislated grade-crossing elimination program, despite restrictions on materials and funding.²⁷⁵

Goethals also assisted in the development of the Edge Plan, which was meant to guide the expenditure of the \$15,000,000 in anticipated revenue. According to contemporary sources, "The Edge plan for a State Highway System under the centralized control of the State and maintained and financed by the State, was the first step that had been taken in New Jersey toward the systematization of our highways."²⁷⁶ Goethals' proposed highway system focused on 650 miles of highways that would have 30-foot wide roadways, 16-foot wide pavements, and 3-foot wide macadam shoulders. Costs would be reduced through the use of convict labor and by directly contracting through the state.²⁷⁷ The use of convict labor in highway construction was first initiated in 1912.²⁷⁸ The Bureau of Public Roads accepted responsibility for housing, feeding, and paying for guards, in exchange for reformatory labor applied towards road construction. The state constructed several camps for this purpose, each of which included dorms, a mess hall, and bathing facilities.²⁷⁹ This highway system, which began as 679 miles of roadway, was steadily increased

²⁷³"The New Highway Law of New Jersey," *Good Roads* 13 (April 21, 1917): 245.

²⁷⁴"R. A. Meeker, State Highway Engineer of New Jersey Resigns," *Good Roads* 14 (December 22, 1917): 327.

²⁷⁵"Continued Activity in New Jersey Road Work Recommended by General Goethals," *Good Roads* 17 (December 29, 1917): 336.

²⁷⁶The Commission for the Investigation of County and Township Highways," 5.

²⁷⁷"Continued Activity in New Jersey Road Work Recommended by General Goethals," *Good Roads* 17 (December 29, 1917): 337.

²⁷⁸New Jersey Commissioner of Public Roads, *Twentieth Annual Report of the Commissioner of Public Roads*, 94.

²⁷⁹"Convict Labor in New Jersey," *Good Roads* 6 (August 9, 1913): 78.

throughout the following decade, so that by 1926 its size had more than doubled to 1,459 miles.²⁸⁰

By 1917, the infusion of federal funds and the creation of a State Highway System, altered the nature of the State's involvement with road construction in New Jersey. Prior to that date, state officials could only administer state aid funds and approve construction documents. The municipality submitting the improvement proposal actually carried out the roadwork. The creation of a State Highway System, however, gave the New Jersey State Highway Department direct jurisdiction over a number of significant routes throughout the state. Involvement at the state level then extended beyond the mere administration of funds into the realm of conducting surveys and supervising construction in the field.²⁸¹

Road Construction

The widespread adoption of freight shipment by truck necessitated fundamental changes in the construction of roads. Trucks carried much heavier loads than carriages and wagons. Prior to the introduction of the automobile, a macadam road in good weather could support the heaviest load that it was possible to move.²⁸² During World War I, truck weight became a major problem. Narrow truck tires were very destructive, since they could shear through the road's surface layer and cause structural destabilization. This had been somewhat of a problem with non-motorized vehicles during the 1890s. At that time, New Jersey passed legislation permitting townships to provide a tax rebate for wagon and carriage owners who equipped their vehicles with four-inch or wider wheels.²⁸³

The combination of relatively narrow tires on powerful, heavy trucks succeeded only in exacerbating the problem. By 1916, states with high traffic loads like New York and New Jersey began discussing the possibility of weight regulation. The concept of working with truck designers to reduce the damage was also proposed.²⁸⁴ Even with additional funding, local taxes could not support the installation of the "highest-type pavement" (pavement type utilizing the most durable type of material available, such as concrete) wherever it was required. One group of engineers felt that in order to reduce wear, and the resulting

²⁸⁰Sidney Goldmann and Thomas J. Graves, *The Organization and Administration of the New Jersey State Highway Department* (Trenton, NJ: N.p., 1949), 350.

²⁸¹New Jersey Commissioner of Public Roads, *Twenty-Fourth Annual Report of the Commissioner of Public Roads* (Union Hill, NJ: Hudson Printing, 1917), 15.

²⁸²MacDonald and Fairbank, "The Development of Improved Highways," *Roads and Streets*, 66 and 71.

²⁸³Morrison, *Highway Engineering*, 7.

²⁸⁴"The Regulation of Motor Truck Traffic," *Good Roads* 12 (November 4, 1916): 195.

maintenance costs, parallel routes should be constructed in high-traffic areas to further distribute the traffic load.²⁸⁵ It appears, however, that this concept was a few decades ahead of its time. Highway department engineers then directed their efforts towards the problem of providing an adequate pavement. Untreated macadam was no longer a viable option in high-volume traffic areas.

The New Jersey State Legislature made a special appropriation in 1911 to fund research on road materials.²⁸⁶ The State's testing laboratory, which was originally established in 1905 to test construction materials, but eventually expanded its range to include road building materials as well, completed the research program.²⁸⁷ Their primary objective was to develop effective binding agents for gravel and broken-stone roads, because historic construction methods that relied on water-bound and traffic-bound macadam were no longer effective.²⁸⁸ New Jersey was fortunate to have substantial deposits of gravel in the central portion of the state, as well as extensive stone quarries near rail lines in the northern region. For that reason, the highway department used these materials extensively during this period.²⁸⁹ Gravel and plain macadam roads accounted for seventy-five percent of improved highways in New Jersey in 1914.²⁹⁰

Loose gravel provided a reasonably good base for roads with a median-range traffic volume, except during the winter and early spring, when they were subject to frost heaves and mud. Materials laboratories analyzed substances like coal tar, water gas tar, glutrin, and Trinidad Liquid Asphalt to determine if their application would enhance the performance of low-grade surfaces like gravel and oyster shells. One New Jersey experiment conducted in 1908 went as far as to mix earth with asphaltum oil to create the country's first "oiled road."²⁹¹ This type of low-grade construction was perfectly appropriate for underdeveloped areas of the state with limited traffic requirements. The

²⁸⁵New Jersey Commissioner of Public Roads, "Eighteenth Annual Report of the Commissioner of Public Roads, 61.

²⁸⁶*Ibid.*, 56.

²⁸⁷Goldmann and Graves, *The Organization and Administration of the New Jersey State Highway Department*, 130.

²⁸⁸Bruce and Clarkeson, *Highway Design and Construction*, 399.

²⁸⁹New Jersey Commissioner of Public Roads, *Fifteenth Annual Report of the Commissioner of Public Roads* (Trenton, NJ: State Gazette, 1909), 5.

²⁹⁰The Commissioner for the Investigation of County and Township Highways, "The Administration of County and Township Highways in New Jersey," 3.

²⁹¹New Jersey Commissioner of Public roads, *Fifteenth Annual Report of the Commissioner of Public Roads*, 51.

majority of roads in South Jersey were constructed of gravel and were considered economical and well maintained.²⁹²

Economics exerted a stronger influence over road construction and design after the war than it had previously, because increased freight shipment along certain routes made the distribution of funds of greater consequence. Funding for construction and improvements could not meet increasing traffic demands. As new pavement choices became available, engineers and legislators realized that all roads could not be treated equally. Levels of quality in design and construction materials soon corresponded closely with levels of use. Certain urban routes served truck-traffic, while other rural areas experienced only light, local traffic. Rather than improving all roads to a certain standardized level, it became obvious that roads should be designed with their intended use in mind. Large towns with a substantial amount of truck traffic required different paving systems than roads in rural areas.²⁹³

In the high-traffic regions of North Jersey, where freight traffic in and out of the metropolitan New York region placed heavy demands on road surfaces, the application of mere binders did not offer an acceptable solution. Preferred pavements in this region were stone block set on concrete foundations, which were then grouted with portland cement, brick pavers laid diagonally to prevent longitudinal ruts, or asphalt concrete. Highway departments used the third material for large scale construction projects, in which the first two materials would have proven too expensive.²⁹⁴ The use of poured concrete as a pavement option gained popularity after 1912. Concrete had been used experimentally as a paving base in New York in 1888 and as an entire paving system in Bellefontaine, Ohio in 1892, but specifications for proper mixes were not developed until 1909.²⁹⁵ In fact, New Jersey can claim the installation of the country's first section of reinforced concrete cement paving, which was laid on Route 24 near New Village in Warren County.²⁹⁶ Paving materials used in New Jersey's state aid projects for 1916 included: gravel, macadam, Ameisite, asphalt concrete, brick, gravel with a lignin binder, bituminous concrete, broken stone, and cement concrete.²⁹⁷ 1917 specifications for roads in the newly designated State

²⁹²New Jersey Commissioner of Public Roads, *Eighteenth Annual Report of the Commissioner of Public Roads*, 57.

²⁹³Archer Butler Hulbert, et. al., *The Future of Roadmaking in America*, 191.

²⁹⁴New Jersey Commissioner of Public Roads, *Twentieth Annual Report of the Commissioner of Public Roads*, 103.

²⁹⁵Upham, "The Last Two Decades in Highway Design, Construction, and Maintenance," 91.

²⁹⁶United States Department of Transportation, *A Nation In Motion: Historic American Transportation Sites*, 50.

²⁹⁷"State Work in New Jersey During the Past Year," *Good Roads* 13 (March 17, 1917): 174.

Highway System required the installation of only hard surface pavements of a durable character such as concrete, bituminous concrete, sheet asphalt, brick, or granite.²⁹⁸

As trucks began to compete directly with freight shipment by rail, improved roads became an increasingly important factor in reducing travel time and transportation costs. The ultimate goal for any transportation type is to move the greatest amount of goods with the least amount of effort. Pavement improvements offered one way of increasing a road's efficiency. Another factor entailed refining and upgrading existing alignments and grades. During the good roads era, most improvements were limited to upgrading the road's surface. Highway departments rarely tackled regrading or improving the existing alignment. After the turn of the century, however a change began to occur. According to the 1913 annual report submitted by the New Jersey Commissioner of Public Roads, "during the past year we have devoted more attention to the correction of alignment than ever before."²⁹⁹

Around the same time, the New Jersey State Highway Commission achieved standardization of cross-sections and profiles.³⁰⁰ Engineers also targeted curves for redesign. Rates of speed rose dramatically through advances in automotive technology during the previous decade. The legal limit in 1913 was twenty-five miles per hour, but the roads had not been engineered for those kinds of speeds.³⁰¹ Due to increasing safety concerns, engineers recommended that in future construction, no curve should be less than 6 degrees or 955 feet radius.³⁰²

By 1908, the generally accepted maximum grade for roadways was to be between eight and ten percent; however the goal was to reduce hills and valleys to the greatest extent possible.³⁰³ The New Jersey Highway Commission encouraged townships to "cut down their hills and fill in their hollows," because eventually major township routes were likely to become state highways themselves. The Commission believed that the larger initial investment necessitated by creating an appropriate alignment and grade at the outset would pay off when the time came for future improvements to the roadway.³⁰⁴ Increased, up-

²⁹⁸"The New Highway Law of New Jersey," *Good Roads* 13(April 21, 1917): 245.

²⁹⁹New Jersey Commissioner of Public Roads, *Nineteenth Annual Report of the Commissioner of Public Roads*, 67.

³⁰⁰*Ibid.*, 65.

³⁰¹*Ibid.*, 66.

³⁰²*Ibid.*

³⁰³Morrison, *Highway Engineering*, 167.

³⁰⁴Hutchinson, "The Good Roads Movement in New Jersey," 110.

front investments in alignment and grading also heightened the importance of installing proper drainage systems and erosion control elements. Features like drains, culverts, cribbing, and retaining walls were crucial to the longevity of grade improvements. Road width did not increase substantially over the preceding era. The pavements of most broken-stone roads in 1908 ranged between nine and sixteen feet in width, significantly below standard widths adopted during the following decade.³⁰⁵ The pavement depths at that time varied according to grade: ten inches deep for a grade less than one percent, eight inches deep for a grade between one and four percent, and six inches deep for a grade over four percent.³⁰⁶

The number and types of attendant highway features rose substantially during this era. Engineers addressed safety issues raised by increased traffic density and rising speeds through the introduction of new roadway elements. While concurrently, the profit motives of property owners along the highways led to the construction of myriad roadside structures designed to cater to the motor-tourist. Increasing numbers of cars on the road necessitated the invention of traffic control procedures and devices. Wayne County Michigan saw the country's first painted center white lines in 1911, and the first "modern" stop sign was introduced in Detroit, Michigan in 1915.³⁰⁷ Earlier stop-and-go signs and semaphores were used to direct traffic during the first decade of the century. The semaphore was a simple, hand-operated stop-go mechanism that evolved into a four-way three-color traffic light by the early 1920s.³⁰⁸ Pedestrian safety was a priority, and the first pedestrian safety island was installed in San Francisco in 1907.³⁰⁹ These islands were used in trolley and bus loading areas and in the center of large intersections. New Jersey also adopted licensing procedures earlier than most states. By 1913, all drivers had to be licensed, not simply chauffeurs, which resulted in a reduced accident rate for the state.³¹⁰

Street lighting took on additional importance during this period, because night-driving prior to the perfection of automobile headlights was a potentially dangerous activity. The invention of the tungsten-filament lamp in 1907 increased the effectiveness of electric street lights. Officials generally installed the new lamps on urban thoroughfares to create "great white ways." Fixtures on rural roads were rare.³¹¹ Once electric lights replaced earlier gas

³⁰⁵Morrison, *Highway Engineering*, 112.

³⁰⁶*Ibid.*, 109.

³⁰⁷Hugill, "Good Roads and the Automobile in the United States 1880-1929," 344.

³⁰⁸*Ibid.*

³⁰⁹Schlereth, *U.S. 40: A Roadscape of the American Experience*, 31.

³¹⁰"Accidents on Highways in New Jersey and New York," *Good Roads* 5, no. 23 (June 7, 1913), 311.

³¹¹Kate Bolton, "The Great Awakening of the Night," *Landscape* 23, no. 3 (1979), 42.

fixtures, many towns developed the habit of turning off all the lights at midnight. This created quite a hazard for the few drivers still on the road. A solution was reached; however, with the introduction of ornamental cluster lighting fixtures. The city extinguished the lower four globes of the fixture at midnight, but the top globe remained lit through the night.³¹² Ornamental lamp posts fabricated of cast iron, pressed metal, or concrete were generally installed in town centers and were often adorned with street signs, flower bowls, drinking fountains, and alarm boxes.³¹³ States kept directional and cautionary signage to a minimum during this era. Roadside features that evolved at this time included: gas stations (Standard Oil opened the first public gas station in 1914 in California), tourist camps, motels, and stands selling produce and other items.³¹⁴ Bridges also came under the jurisdiction of the State Highway Department during this period. For additional information on the state's bridge types and their periods of development, the New Jersey Historic Bridge Survey prepared by A. G. Lichtenstein Associates for the New Jersey Department of Transportation is the most comprehensive source of information.³¹⁵

Towards A Unified Highway System (1917-1946)

Road Use

National patterns of highway use were in place by the close of World War I. The ways in which roads were used between 1917 and 1946 did not differ dramatically from the previous era. Vehicular traffic volume did, however, show a radical increase, which led to notable changes in highway design and planning during this period. Five years after World War I ended, T. H. MacDonald, Director of the Bureau of Public Roads, identified four major use categories for roads. Agricultural roads comprised the first group, and functioned as a connection between farms and markets. These roads were generally local in nature, providing access to farmland, as well as a route for conducting daily business like marketing, socializing, and church and school attendance.³¹⁶ Recreational roads, including local pleasure driving routes or routes to major tourist destinations, made up the second category. Commercial highways comprised another major type. These highways

³¹²Ibid., 45.

³¹³Ibid.

³¹⁴John A. Jakle, "The American Gasoline Station, 1920-1970," *The Journal of American Culture* 1 (Fall 1978), 521.

³¹⁵A.G. Lichtenstein Associates, "The New Jersey Historic Bridge Survey Draft," (Unpublished Report for New Jersey Department of Transportation and the Federal Highway Administration, September 1994). Located at the Bureau of Environmental Analysis, New Jersey Department of Transportation, Trenton, NJ.

³¹⁶Chatburn, *Highways and Highway Transportation*, 223.

primarily served express traffic hauling agricultural goods and other types of freight, as well as inter-city bus traffic. The final category were military roads, which provided general support for military activities.³¹⁷ One category that did not make MacDonald's list, but was extremely significant during the period following 1923, and certainly more widely acknowledged than military roads during the inter-war years, is the commuter road. An outgrowth of the agricultural road type, the commuter road served a similar role by facilitating activities of daily life, but catered to the growing suburban enclaves in New Jersey's metropolitan regions.

Road conditions after World War I were very poor. No maintenance had been conducted for several years, and the pre-war paving systems had not been appropriate for the loads carried. The main goal of road building activities after the war was to repair the existing system and to finalize construction of a network of two-lane, paved roads linking population centers. Often state highway departments did not base their post-war construction programs on any statewide plan. Construction projects were carried out in a rather haphazard fashion, and as a result, many of these routes were obsolete before the road networks were complete.³¹⁸ The New Jersey Highway Department did not, however, fall into this trap.

It was apparent by 1926 that the system of roads established by the 1917 legislation was not adequate for post war needs. Additional routes had been added to the original fifteen highways, but the legislature wanted a new comprehensive plan that would be used to inform future construction programs.³¹⁹ William G. Sloan, state highway engineer, conducted a traffic study for the state. His report took an innovative approach by differentiating between local traffic and terminal traffic-traffic that passed through the state to other large population centers like New York and Philadelphia.³²⁰ Many considered Sloan's study to be "the first effort made in New Jersey to deal with its highway problems on a broad scale. It was daring in its scope."³²¹ Sloan's plan called for the creation of a 1,247-mile primary road system that would be maintained by the state and a 647-mile secondary road system that would be maintained by the counties.

³¹⁷Ibid., 224.

³¹⁸Bruce and Clarkeson, *Highway Design and Construction*, 29.

³¹⁹Goldmann and Graves, *The Organization and Administration of the New Jersey State Highway Department*, 10.

³²⁰"State Highway Planning Based on Traffic Study," *Good Roads* 36 (January 27, 1927), 76.

³²¹Goldmann and Graves, *The Organization and Administration of the New Jersey State Highway Department*, 350.

Sloan's top priorities for new construction were the identified terminal traffic routes. His plan proposed the construction of an additional hundred miles of road in the metropolitan New York Area, thirteen miles around Camden, and twenty-seven miles around Trenton.³²² Sloan also recognized that the vicinity around Newark would need special attention in future road construction projects. The Newark area, which measured approximately five miles by nine miles, contained one-fifth of New Jersey's population at the time. It also had an extremely high commuter and freight traffic flow.³²³ Analysis of existing traffic flows and patterns throughout the state, as well as projections of future conditions, informed all new construction projects. Engineers anticipated that this information would help alleviate traffic problems formerly caused by mixing local and terminal traffic.

Sloan's study also recommended that the New Jersey State Highway System be designed and used primarily for through traffic between important population centers.³²⁴ The optimum system would be designed to segregate traffic by terminal destination and to develop independent highways to carry each group of traffic to its ultimate goal as quickly as possible.³²⁵ Studies of current traffic flow were conducted and then charted in order to identify these different traffic groups.

After the Holland Tunnel and Delaware River Bridge (Benjamin Franklin Bridge) were opened, New Jersey faced a considerable increase in foreign traffic traveling through the state.³²⁶ This traffic constituted a major dilemma, because the state had become a transportation conduit used largely by foreign traffic that did not provide revenue for the construction or maintenance of the state's highway system. According to 1928 statistics, the population within a ten-mile radius outside New Jersey's boundaries amounted to twice the state's own population.³²⁷ The Holland Tunnel and Delaware Bridge enabled many of these residents to travel easily into New Jersey, and this became a major highway planning consideration. The New Jersey State Highway System held a steady 30-percent annual increase in traffic throughout the 1920s, with even greater growth on major routes like the

³²²"State Highway Planning Based on Traffic Study," *Good Roads* 36: 76.

³²³W. G. Sloan, "Comprehensive Highway Plan for the State of New Jersey," (Unpublished report New Jersey State Library, 1928), 38.

³²⁴*Ibid.*, 7.

³²⁵*Ibid.*, 11.

³²⁶*Ibid.*, 12.

³²⁷H. W. Giffin, "Some Factors Which Influence Highway Design," *Good Roads* 71 (May 1928), 303.

White Horse Pike and the Lincoln Highway.³²⁸ The state's 1935 traffic survey revealed that New Jersey had a higher proportion of foreign passenger traffic on its roads than any other eastern state.³²⁹

Sigvald Johannesson, the New Jersey Highway Department's renown engineer and economic analyst, reevaluated the state's highway needs in 1944. His report stated that the goals of the highway department after the war were to continue work conducted in previous decades including: connecting county seats and population centers, creating links to other state's highway systems, and providing access to areas of scenic beauty in the state. Additional objectives of more pressing concern included the creation of bypasses and parallel routes to relieve overburdened highways and the construction new roads through undeveloped parts of the state in order to encourage future development.³³⁰

Johannesson also identified important transportation needs in various parts of the state. The mountain region required easier access from Manhattan in order to increase its popularity as a tourist destination. The suburban area outside New York needed an innovative design approach that could address both increasing congestion and rising costs for road improvements in densely-developed areas. The Atlantic coastal area could be improved through the construction of lateral east-west connections between state routes and coastal drives. The inaccessibility of the Pinelands could be remedied by the creation of roads into that region. Although a viable system of trunk routes through the southern agricultural region existed, improvements could still be made. Finally, Camden and Trenton both experienced significant increases in through traffic during the 1930s. Johannesson proposed an additional bridge or tunnel connecting with Philadelphia for the former and a system of bypasses for the latter.³³¹

World War I made freight shipment by truck indispensable, and the use of motor trucks continued to grow after the war. The introduction of heavy-duty, low pressure tires in 1932 enabled trucks to transport shipments even more effectively. By the mid-1930s, trucks began to compete with railroads, not just for local or regional shipments, but for

³²⁸State of New Jersey Highway Commission, "Annual Report of Superintendent of Maintenance - Fiscal Year From January 1, 1927 to December 31, 1927" (Unpublished Report New Jersey State Library, 1917), No page numbers provided.

³²⁹L. E. Peabody, "Some Characteristics of Traffic on New Jersey's Highways: Extracts From a Report on the New Jersey Traffic Survey," *Public Roads* 16, no. 2 (April 1935), 22.

³³⁰Sigvald Johannesson, *New Jersey State Highway Department Planning Bureau - A Comprehensive State Highway System* (Trenton, NJ: N.p., 1944), 2.

³³¹*Ibid.*, 4-6.

long-distance hauls as well.³³² Trucks accounted for 12 percent of all traffic on New Jersey highways in 1935. Levels of truck traffic varied throughout the state; however, Hudson, Bergen, Camden, and Middlesex Counties had unusually high rates.³³³ Route 1, the Lincoln Highway, which was then considered the country's "greatest transcontinental route," had the highest concentration of truck traffic. New Jersey's stretch of the Lincoln Highway consisted of 57.6 miles of roadway connecting New York, Jersey City, Newark, New Brunswick, Trenton, and then on to Philadelphia.³³⁴ During the 1930s, the section of Route 1 between Trenton and the Holland Tunnel averaged 16,000 vehicles per day.³³⁵

Trucks served a variety of transportation functions in New Jersey, a state known both for agricultural produce and manufacturing. Motor trucks conveyed produce from farming districts, carried out the radial distribution of goods from large cities to smaller towns, and distributed goods between railroad lines.³³⁶ In 1935, 66 percent of trucks on New Jersey's highways had both their origin and their destination within the state. The remaining 34 percent either carried New Jersey-made products to foreign destinations or delivered shipments of foreign goods to destinations within the state.³³⁷ In South Jersey, the majority of trucks on the road in 1935 were owner-operated and used to deliver agricultural produce, forest products, coal, oil, or retail products.³³⁸ Shipment by truck had an enormous impact on national transportation systems during this era. According to historian Spencer Miller, "practically all farm products were carried by trucks either direct to market or to the nearest railroad terminal, and 56 percent of all livestock received at all stockyards was hauled by truck in 1942."³³⁹

Motorization of American life began in earnest in the 1920s. The car became a household fixture for many families, and according to contemporary observers, had unanticipated effects on daily life. George Chatburn's 1923 book *Highways and Highway Transportation* recounts some of these changes. According to Chatburn, many people succumbed to the pull of the open road during the 1910s and 1920s. Consequently, individuals were content to live in small apartments, because they spent leisure time touring

³³²William A. Bresnahan, "Freight Transportation On The Highway," 248.

³³³Peabody, "Some Characteristics of Traffic on New Jersey's Highways, 22.

³³⁴Charles E. Murphy, "Sheet Asphalt Paving On Lincoln Highway: New Jersey Repaves Final Link Between Princeton and Trenton, NJ," *Good Roads* 33, no. 3 (September 1925), 273.

³³⁵Peabody, "Some Characteristics of Traffic on New Jersey's Highways, 17.

³³⁶Chatburn, *Highways and Highway Transportation*, 216-217.

³³⁷Peabody, "Some Characteristics of Traffic on New Jersey's Highways, 27

³³⁸*Ibid.*

³³⁹Miller, "History of the Modern Highway in the United States," 96.

in their automobile. Church attendance declined. Newspapers and books went unread. People took less care with their appearance, preferring khakis to suits that were perpetually ruined by grease spots and dust. Chatburn even targeted automobiles as a cause for the decline in the housing market. According to this logic, many families were saving all their spare money for a car, and as a result, they spent less on house repairs and new construction.³⁴⁰

Those without the means to own their own car, could still take advantage of motorized transit by using taxi cabs or the less expensive motor bus. Buses traveled routes within cities, but also provided extensive services to suburban districts, between towns seventy-five to one hundred miles apart, and between railway terminals.³⁴¹ The introduction of buses also facilitated the movement to consolidate rural schools. Counties replaced one-room school houses with modern, centrally located buildings once buses began to be used for transporting school-children. Between 1920 and 1930, school buses accounted for 50 percent of all bus production in the country.³⁴²

Traveling salesmen readily adopted the car, which made their rounds much easier. Cars also shortened the perceived distance between rural areas and mid-size towns, which in turn, altered shopping patterns. Mid-size towns began to market specialty merchandise, while small country stores focused on providing staple goods.³⁴³ Even health care witnessed the effects of motorization. House calls became a rarity, since families could drive their own car to the doctor's office and ambulances provided emergency service. By the 1940s, physicians treated most people in hospitals or offices, not in their homes. The length of average rural mail delivery routes continued to grow, as roads were improved and automobile speeds rose. Certain organizations also took advantage of the car's reliability and flexibility to offer additional services to country families, such as bookmobiles and extension agency programs.³⁴⁴

Introduction of the automobile led to an entirely new form of recreation - motor touring. The car allowed Americans to see their country in a new way and gave them the flexibility to take the uncharted path and travel at their own pace.³⁴⁵ Rand McNally introduced a

³⁴⁰Chatburn, *Highways and Highway Transportation*, 203.

³⁴¹Ibid., 216.

³⁴²Dearing, *American Highway Policy*, 144.

³⁴³Chatburn, *Highways and Highway Transportation*, 207.

³⁴⁴Poyntz Tyler, ed. *American Highways Today*, vol 29, 33-35.

³⁴⁵Warren James Belasco, *Americans on the Road: From Autocamp to Motel, 1910-1945* (Cambridge, MA: The MIT Press, 1979), 22-23.

popular product in 1926; the first road atlas of the United States.³⁴⁶ A comprehensive atlas was quite a boon to the motorist, since few routes had signs in the 1920s, and it was important to have the most updated information. In addition, routes and their condition sometimes changed on an annual basis. Motor-gypsies throughout the country enjoyed traveling light, being out in nature, and camping. Many were nostalgic for earlier eras, and promoters of the movement identified it with the days of carriages and stagecoaches.³⁴⁷ The countryside became so accessible, that by the early 1930s, some urban planners felt that urban parks were no longer needed, and that parkways should take their place.³⁴⁸

There were considerable numbers of touring motorists at the time, estimated at one million people in 1923, and a new industry arose to meet their needs. Public auto-camping grounds sprang up to accommodate the basic needs of motor-tourists in over 3,000 cities across the country.³⁴⁹ As the novelty of roughing-it wore off, tourists sought the amenities of motels in the late 1920s and 1930s. Motels were a totally different breed from the opulent downtown railroad station hotels of the previous century. Motel owners emphasized cleanliness, basic amenities, and privacy; not opulence and luxury. In the 1920s, many motels contained clusters of individual cottages. In the 1930s, the motor court became more common, and by the 1950s, motels expanded their amenities to include public outdoor areas and pools.³⁵⁰ Some rural property owners sought to cash in on tourist traffic by renting out rooms or establishing their own motels. A contemporary observer noted motel owners' spring tendency to "clean and spruce up with the idea of securing as much of this traffic as good service reported by the camaraderie of travelers all along the way will bring them."³⁵¹ Not all country residents, however, were happy with the influx of urban tourists. These visitors were not always gracious guests, and some were known to disturb the state's bucolic splendor by trampling flowers, raiding gardens, and vandalizing and looting property.

During this era, New Jersey's shore and mountain resorts garnered nationwide acclaim.³⁵² Travelers from Pennsylvania and New York, as well as others from far-flung locations, came to take advantage of the state's recreational possibilities. The auto-camping and motel

³⁴⁶Hugill, "Good Roads and the Automobile in the United States 1880-1929," 344.

³⁴⁷Belasco, *Americans on the Road: From Autocamp to Motel, 1910-1945*, 22-23.

³⁴⁸Herbert Swan, "The Parkway as Traffic Artery," *The American City* 45 (October 1931), 84.

³⁴⁹Chatburn, *Highways and Highway Transportation*, 451.

³⁵⁰Schlereth, *U.S. Route 40: A Roadscape of the American Experience*, 98.

³⁵¹Chatburn, *Highways and Highway Transportation*, 207.

³⁵²L. E. Andrews, "Modern Road Improvement Practice Sets High Standards," *Engineering News-Record* 95, no. 2 (July 9, 1925), 48.

industries likely played a major role in New Jersey motor-tourism during this period. The novelty of motor-touring that emerged in the 1910s continued throughout the 1930s. By the end of this era, however, the primary use for the automobile was functional, not simply recreational. The November 1935 edition of *Architectural Record* notes, "Motoring may still be carriage exercise for some, but I think the number who drive for the sake of being outdoors and enjoying the scenery is constantly diminishing and that most persons motor to get somewhere for business or pleasure."³⁵³

Commercial development followed the motorist, spreading out from urban centers along new highway networks. Merchandisers did not miss any opportunity for a sale, and soon open air stalls selling everything from produce to crafts dotted the roadsides.³⁵⁴ A billboard frenzy also arose at this time. Some national companies commissioned professionally designed billboards, but property owners along popular highway routes also built large, hand-painted signs promoting their own stands. In addition, farmers often attached metal "snipe" signs to their outbuildings to promote all types of products.³⁵⁵

During the 1920s, local merchants and hotelkeepers developed a mutually beneficial relationship with trails association organizations. These private organizations charted out and promoted highway routes throughout the country. Among the best-known roads of this type is the Lincoln Highway. Members of trail associations lobbied for road improvement on their routes, which were often given distinctive names like Old Spanish Trail, Victory Highway, or Red Arrow Highway.³⁵⁶ The organizations also created and installed signs, often painted on utility poles, developed maps, and generally promoted the route. Roadside businesses often provided funds for these activities, in an effort to attract tourist traffic.³⁵⁷ By the late 1920s, the effectiveness of this promotional effort began to wane. Too many routes had been charted, many overlapped, and the cachet and novelty had dissipated.

While some today feel nostalgia for these roadside novelty enterprises, many at that time derided this type of development. Those who felt that commercialization of highways ruined the countryside, labeled this phenomenon ribbon development or motor-slums.

³⁵³"New Towns For High Speed Roads," *The Architectural Record* 78, no 5 (November 1935), 352.

³⁵⁴Poyntz Tyler, ed., *American Highways Today*, vol. 29.

³⁵⁵Jan Jennings, ed., *Roadside America: The Automobile in Design and Culture* (Ames, IA: Iowa University Press, 1990), 176.

³⁵⁶Schlereth, *U.S. 40: A Roadscape of the American Experience*, 9.

³⁵⁷*Ibid.*, 8.

Lack of control over roadside development led to a decline in adjacent property values and caused congestion and safety problems as cars pulled on and off the road.³⁵⁸ This impact is further discussed in an excerpt from a 1932 issue of *The American City*: "The borders of most state and county highways today are not desirable for residential use, for two reasons, because of the noise and confusion caused by the continual flow of traffic, second, because almost invariably, particularly in suburban and rural communities, sporadic occurrences of commercial uses such as billboards, hot dog stands, filling stations, repair garages and the like have even made it undesirable."³⁵⁹

A few national corporations like Standard Oil attempted to address these concerns by removing their product billboards and designing their businesses in a way that would blend with local domestic and vernacular building traditions.³⁶⁰ One reform group, which was funded by the Rockefellers, also sponsored contests to promote a more-refined approach to commercial architecture than was currently employed.³⁶¹ These activities, however, had a limited impact on existing conditions. Limited-access freeways were proposed as a remedy to this situation in the 1930s, but the legislation enabling the state to restrict roadside access had not yet been passed.

Suburban growth remained strong throughout much of this period, despite roadside problems of commercial ribbon development. Construction of extensive highway networks enabled developers to free themselves from their nineteenth-century ties to the commuter rail lines and reach into new territories. By 1940, 10 percent of new residential development was located over a mile away from the nearest rail line.³⁶² During this era, new construction in areas outside metropolitan regions was much more affordable in terms of initial cost and property taxes. George Chatburn observed in 1923 that "by the aid of the automobile, property will be bought in farther out districts where lots are cheaper, where taxes are not so high, where there is more breathing space, and healthful conditions are more likely to prevail. Men of wealth can build suburban estates, and men of less means comfortable homes leaving the downtown apartments and tenements to those who cannot yet afford motor cars, and many there be, more's the pity."³⁶³

³⁵⁸"Modern Motor Arteries," *The American City* 43 (July 1930), 107.

³⁵⁹Latham C. Squire and Howard M. Bassett, "A New Type of Thoroughfare: The 'Freeway'," *The American City* 47 (November 1932), 65.

³⁶⁰Jennings, ed., *Roadside America*, 178.

³⁶¹*Ibid.*, 176.

³⁶²Rae, *The Road and Car in American Life*, 203.

³⁶³Chatburn, *Highways and Highway Transportation*, 206.

In other states, such as in Westchester County, New York, the parkway design developed as a way of providing a fast commuter route, while creating a scenic buffer to protect surrounding property values.³⁶⁴ The advantage of freeway and parkway design lay in the fact that the roadside frontage could not be developed commercially, thus preserving the residential value of nearby land.³⁶⁵ The November 1935 issue of *Architectural Record* discussed the recent trend of locating new subdivisions near superhighways noting that "if they are skillfully planned in relation to the highway and the nearby town, they are likely to become the most desirable residential districts."³⁶⁶ Express highways became an important feature of the upscale suburb. Local traffic caused severe congestion on many of the earlier highways, which resulted in a long, tedious commutes and unhappy residents. New Jersey engineers, however, did not begin to utilize parkways until after World War II, even though there was an expressed need for such a design.

Regional planning groups recognized that traffic congestion had become a major problem as early as the 1920s. Downtowns faced gridlock due to increased traffic volume and lack of parking facilities. The Depression and World War II limited new construction, which only exacerbated the problem. Municipalities and highway departments had spent the past twenty years creating passable roads for people to use, but without any consideration of where people would put their vehicle once they arrived at their destination. Main streets could only support a limited number of parking spaces, which proved frustrating for downtown shop owners. Once those spaces were filled, no more customers could park until a space became free. In response, savvy developers began to construct new shopping areas on the outskirts of towns, where there was plenty of room for parking. Stores like the "Park and Shop" in Washington, D.C., which was built in 1937, set the precedent for post-World War II commercial development.³⁶⁷

An Oklahoma inventor provided one answer to the downtown parking problem in 1935 with the invention of the world's first parking meter. The Dual Parking Meter Company installed Oklahoma City's parking meters at no cost, and the proceeds of the meters were used to pay for them.³⁶⁸ In the next few years, cities throughout the country began installing their own meters. Municipal officials were quite pleased with the results, as were downtown store owners. Although some motorists resented the parking fee, most accepted

³⁶⁴Squire and Basset, "A New Type of Thoroughfare," 65.

³⁶⁵Herbert Swan, "The Parkway as Traffic Artery," 86.

³⁶⁶"New Towns for High Speed Roads," *The Architectural Record* 78, no. 5 (November 1935), 354.

³⁶⁷"Park and Shop," *The American City* 52 (October 1937), 71.

³⁶⁸"Parking Meters in Oklahoma City," *The American City* 50 (August 1935), 61.

it in the interest of having a better chance at finding a parking space. Parking lots and parking garages were also popular in areas that had empty lots to accommodate them. A 1929 article in *The American City* noted that "in wide-awake municipalities everywhere, all available unoccupied lots are being converted into attractive parking spaces."³⁶⁹ In other instances, however, it was recommended that the construction of parking garages be used as an urban renewal tool. "Backwaters of shabby boarding-houses, rickety tenements, and empty warehouses-buildings too old for comfortable habitation" could be demolished and their places taken by new parking garages that would not only reduce traffic congestion, but also become successful financial ventures for cities.³⁷⁰

By the 1940s Sigvald Johannesson stated that throughout the State of New Jersey there existed "an accumulation of undone, but immediately needed State highway work, the completion of which cannot be delayed without seriously effecting the prosperity of the state."³⁷¹ During the first two decades of the century, New Jersey's highways were designed to connect population centers. Most routes passed directly through these urban areas, generally on the town's main street. Increasingly after 1920, Main Street could no longer handle both local and through traffic. By-passes, connector highways that lay outside cities, but in close proximity to them, presented engineers with one solution. The by-pass concept could be applied on a variety of scales. Some of these highways were merely express, non-business routes around mid-size towns. Others were part of larger highway systems. Parts of North Jersey were incorporated into a proposed-plan for an enormous "Metropolitan Loop" around the New York City area in 1933. The loop, which was planned on a much larger scale than most bypasses, was intended to create a giant beltway between cities like Elizabeth, Paterson, the Bronx, and Brooklyn at a twelve-mile distance from mid-town Manhattan.³⁷² It is not clear if portions of such a loop were ever actually realized. Supplementing the by-pass solution was a new approach in which engineers surveyed and fixed new routes on the outskirts of towns. The following routes illustrate this new strategy developed in the 1920s: Route 25 from Newark to Camden, Route 4 from the George Washington Bridge to Cape May, Route 29 from Newark to Trenton, and Route 23 from Verona to Port Jervis.³⁷³ Eventually, the combination of

³⁶⁹Lee J. Eastman, "The Parking Garage Merits Encouragement as an Important Factor in Traffic Relief," *The American City* (January 1929), 157.

³⁷⁰Ibid.

³⁷¹Sigvald Johannesson, "New Jersey State Highway Department Division of Planning and Economics - Monographs on the Highways of New Jersey," (Unpublished Report New Jersey State Library, 1947), 11.

³⁷²W. Russell Tylor, "Social Factors in Development of Regional Highways," *Roads and Streets* 76, no. 6 (June 1933), 221.

³⁷³Goldmann and Graves, *The Organization and Administration of the New Jersey State Highway Department*, 384.

increasing downtown congestion and enhanced funding for the construction of expressways after World War II resulted in the relocation of many businesses and industries away from urban centers to newly developed locations off the interstate.³⁷⁴

Road Legislation and Financing

The New Jersey Legislature created the state highway department to fulfill a variety of functions, each of which required varied levels of funding. The highway department's responsibilities in 1942 included constructing, maintaining, and repairing the highway system; developing planning surveys; conducting research and materials testing; providing the safest roads possible; landscaping the highway system; snow and ice removal; grants-in-aid administration; equipment maintenance; and public education.³⁷⁵ At that time, the five sources of revenue that supported the above activities included: a one-mil property tax, bond issues, gasoline tax, motor vehicle registration and inspection fees, and Federal grants-in-aid.³⁷⁶ The state issued a series of major bond issues for road construction in 1922, 1927, and 1930.³⁷⁷

By the late 1920s, some states began to recognize that highway users should bear a larger cost for the construction and maintenance of roads than they had been paying in fees up to that time. A gasoline tax was determined to be the best and most equitable way to raise supplemental revenue, since it was directly related to the degree of automobile use.³⁷⁸ Oregon was the first state to impose a fuel tax in 1919, and by 1930 all states had some form of gasoline tax.³⁷⁹ New Jersey taxed gasoline at a rate of two cents per gallon in 1927, and annual automobile fees amounted to between five and ten dollars per vehicle.³⁸⁰

After federal aid funds became available, states assumed greater responsibility for road construction, and counties played a reduced role. A significant amount of construction and repair work took place after the close of World War I. The federal government appropriated additional funds through the Federal Aid Road Act of 1920 in order to

³⁷⁴Rae, *"The Road and the Car in American Life"*, 251.

³⁷⁵Goldmann and Graves, *The Organization and Administration of the New Jersey State Highway Department*, 229.

³⁷⁶*Ibid.*, 167.

³⁷⁷*Ibid.*, 171.

³⁷⁸E. W. James, *Highway Construction, Administration, and Finance* (Washington, DC: Highway Education Board, 1929), 109.

³⁷⁹Thomas MacDonald, "How Highway Financing Has Evolved," 5.

³⁸⁰James, *Highway Construction, Administration, and Finance*, 112.

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regular federal appropriations.³⁹³ The 1933 National Industrial Recovery Act allotted New Jersey \$6,346,039 for road improvements and was followed the next year by \$3,220,879 provided through the Hayden-Cartwright Act.³⁹⁴ In 1938, the state inaugurated its \$25 million W.P.A. road program for which the state agreed to provide \$5 million in sponsorship funds.³⁹⁵ Between 1933 and 1949, relief agencies spent \$4 billion on road construction projects across the country.³⁹⁶

The Bureau of Public roads continued to administer the federal grants-in-aid program during this period. In 1939, the agency was renamed the Public Roads Administration. Supplementary relief programs provided to states during the Depression enabled the federal aid program to continue to expand. The federal government extended aid to urban segments of primary roads in 1933 under the National Industrial Recovery Act.³⁹⁷ Previously, states had been required to secure independent financing for road improvement programs within cities.³⁹⁸ This was an important change for New Jersey, a state with significant areas of urban development. Costs for road improvement projects spiraled upwards in heavily populated counties like Bergen, Essex, Hudson, Passaic, and Union. Property values were so high in these areas that procuring additional rights-of-way for improvements or new construction had become unfeasible in many cases.³⁹⁹ This situation effectively stalled the implementation of superhighway designs during much of the 1930s. The expressway design was only effective in large stretches, and large blocks of funding for their construction were difficult to obtain until after World War II.⁴⁰⁰

As a result of the financial circumstances during the 1930s, considerable effort was spent to develop a system of economic analysis for road improvements. Sigvald Johannesson, a New Jersey Highway Department engineer with a background in railroad design, was instrumental in creating an application in which traffic projections and economic factors were combined to evaluate roadway improvement alternatives. Johannesson proved that in many cases, larger initial investments in road infrastructure would result in greater long-term economic gain, if the design and location of the project enhanced traffic flow and

³⁹³Rae, *The Road and Car in American Life*, 74.

³⁹⁴Goldmann and Graves, *The Organization and Administration of the New Jersey State Highway Department*, 179.

³⁹⁵*Ibid.*, 426.

³⁹⁶Rae, *The Road and Car in American Life*, 74.

³⁹⁷Seely, *Building the American Highway System*, 155.

³⁹⁸Rae, *The Road and Car in American Life*, 74.

³⁹⁹Goldmann and Graves, *The Organization and Administration of the New Jersey State Highway Department*, 359.

⁴⁰⁰Seely, *Building the American Highway System*, 155.

reduced transportation costs. This approach was successfully utilized in New Jersey's renowned Pulaski Skyway.⁴⁰¹ Johannesson later published the first book on the subject, entitled *Highway Economics*.

America's entry into World War II had considerable impact on national highway construction. After the bombing of Pearl Harbor, the Public Roads Administration issued an order that all non-federal-aid road programs were to be discontinued, except those that were deemed essential for national defense. This decree resulted in a significant decrease in construction activity in New Jersey. The state's war-time efforts focused on creating, improving, and maintaining access roads for military installations such as Fort Dix, Picatinny Arsenal, Bayonne Naval Dry Dock and Supply Base, Fort Monmouth, and Fort Hancock.⁴⁰² Funding for these projects came from the 1941 Defense Highway Bill, which Congress passed with the goal of correcting "critical deficiencies in highways and bridges essential to national defense."⁴⁰³ The bill included a \$150 million appropriation to be applied nationally towards the construction of roads accessing military and naval reservations, defense industries, and important sources of raw materials.

Congress also recognized that war would result in a protracted period of limited road construction activity, and that by peacetime, America would face a tremendous project backlog and an impending transportation crisis. Therefore, an additional provision was incorporated into the Highway Defense Act that funded extensive survey and planning projects. States later used these plans as the basis for implementing expanded post-war highway programs.⁴⁰⁴ The federal government provided \$10 million in matching funds to the states for this purpose.⁴⁰⁵ The importance of proper planning was already recognized in the late 1920s, "the application of scientific study to the problem of providing America's future traffic with adequate facilities is of utmost importance."⁴⁰⁶ Highway departments were encouraged to secure right-of-way of adequate size to permit future widening and to construct bridges that could be easily enlarged. A provision in the 1934 Federal Highway

⁴⁰¹Miller, "History of the Modern Highway in the United States," 103.

⁴⁰²Goldmann and Graves, *The Organization and Administration of the New Jersey State Highway Department*, 441.

⁴⁰³"Defense Bill Enacted," *The American City* 56 (December 1941), 105.

⁴⁰⁴Mark Rose, *Interstate: Express Highway Politics 1939-1989* (Knoxville, TN: University of Tennessee Press, 1990), 17.

⁴⁰⁵Wilbur H. Simonson, "Advanced Designs For Post-War Highway Needs: Survey of Current Development With Thought To the Future," *Landscape Architecture* 33, no. 4 (July 1943), 130.

⁴⁰⁶Wyatt B. Burmitt, "The Superhighway," *The American City* 40, no. 1 (January 1929), 88.

Act advocated the development of planning surveys by requiring that 1.5 percent of federal aid funds be spent in that area.⁴⁰⁷

A turning point in the development of United States transportation occurred in 1944. That year, Congress created a third federal aid system. The National System of Interstate and Defense Highways was created to supplement the existing primary (trunk-lines) and secondary (feeder routes) programs.⁴⁰⁸ It is generally acknowledged that this authorization set the tone for post-war highway development. According to Robert Rollings, a researcher for the Automotive Safety Foundation, this legislation established "basic patterns for long-range post-war highway construction programs by providing authorizations for federal-aid primary highways in rural areas, federal-aid projects in urban areas, for projects on the federal-aid secondary system, and provided for designation of the National System of Interstate and Defense Highways not exceeding 40,000 miles."⁴⁰⁹ An initial appropriation of \$1.5 billion dollars was made towards road construction for the following three years.⁴¹⁰

Larger blocks of funding, however, did not become available until the mid-1950s. The Federal Interstate Highway Act was passed in 1956 with a budget of \$25 billion, which increased the annual appropriation of federal road funds for states by three times.⁴¹¹ The legislation also created a national "highway trust fund" to hold additional revenues from national taxes on fuel and tires.⁴¹² In the mid-1950s, the federal government had primary responsibility for financing the interstate system, since they provided 90 percent of construction costs, and states were merely required to provide a 10 percent match.⁴¹³

The upper mileage limit for the interstate system was to be 40,000 miles, and most states had their routes designated on paper by 1955. While it was to consist of only approximately 1.1 percent of all rural roads, the system was designed to carry 20 percent of all rural traffic and connect all state capitols and most cities with a population of 50,000 or

⁴⁰⁷United States Department of Transportation, *A Nation in Motion*, 123.

⁴⁰⁸W. Brewster Snow, ed., *The Highway and the Landscape* (New Brunswick, NJ: Rutgers University Press, 1959), 62.

⁴⁰⁹Robert C. Rollings, *Highway Facts U.S.A. 1952* (Washington, DC: The Automotive Safety Foundation, 1952), 15.

⁴¹⁰United States Department of Transportation, *A Nation in Motion*, 124.

⁴¹¹Schlereth, *U.S. 40: Roadscape of the American Experience*, 20.

⁴¹²United States Department of Transportation, *A Nation in Motion*, 124.

⁴¹³W. Brewster Snow, ed., *The Highway and the Landscape* (New Brunswick, NJ: Rutgers University Press, 1959), 62.

more.⁴¹⁴ Existing routes, including some primary roadways and most modern toll roads, comprised 30 percent of the system, with new construction accounting for the remaining 70 percent.⁴¹⁵ Although military and defense considerations were a primary impetus for the designation of the interstate system, the creation of a new highway network was determined to have a variety of additional advantages. One supporter of Roosevelt's plan noted that in addition to providing the strategic transportation network mandated by the Secretary of War, the interstate system would increase manufacturing efficiency and provide post-war employment for demobilized soldiers.⁴¹⁶ The interstate system was also designed to create direct connections between metropolitan areas and industrial centers and to establish highway links with Canada and Mexico.⁴¹⁷

In addition to major undertakings like the creation of the interstate system, other more minor legislative initiatives during this period had an impact on highway design. Due to a troubling rise in accident rates, Congress provided additional funding for the elimination of grade crossings in 1936.⁴¹⁸ Another aspect of the 1933 National Industrial Recovery Act was the determination that appropriate landscaping for parkways or highways with extensive mileage was a priority.⁴¹⁹ The same year the Bureau of Public Roads began to require that .5 percent and later 1 percent of federal aid funding be spent on trees and landscape improvements.⁴²⁰ New Jersey had a policy in place with respect to tree planting and protection since 1929, in the form of the Tree Injury or Destruction Act.⁴²¹

The New Jersey Highway Department conducted a state-wide survey to determine the level of the state's highway deficiencies in 1947. The study concluded that \$600 million was needed to address existing problems. The highway department's annual appropriation, however, was only \$30 million a year. At the time, there was considerable nationwide discussion concerning the best approach for road finance, toll or federal aid. The 1941 Highway Defense Act, steered many states that received sizable allocations for defense industry access roads towards the latter solution.⁴²²

⁴¹⁴Bruce and Clarkson, *Highway Design and Construction*, 11.

⁴¹⁵Snow, ed., *The Highway and the Landscape*, 62.

⁴¹⁶"Superhighways for Tomorrow," *Landscape Architecture* 34, no. 3 (April 1944), 113.

⁴¹⁷Rollings, *Highway Facts U.S.A.* 1952, 13.

⁴¹⁸*Ibid.*, 14.

⁴¹⁹"The Objectives of Roadside Development," *Roads and Streets* 77, no. 4 (April 1934), 135.

⁴²⁰"Roadside Planting," *Landscape Architecture* 26 (July 1936), 168.

⁴²¹J. M. Bennett, *Roadside Development* (New York: MacMillan and Company, 1929), 243.

⁴²²W. Brewster Snow, ed., *The Highway and the Landscape*, 25.

Federal aid alone could not begin to solve New Jersey's road financing problems. According to historian John Rae, "after the Second World War, New Jersey's highway system had a traffic density seven times the national average, and main routes approaching New York City were carrying twice their planned capacity."⁴²³ Sigvald Johannesson's 1944 highway plan for the state also recognized that future road improvements would have to double the size of the current system over the next thirty years, simply to maintain the existing standard of living.⁴²⁴ The state began leaning towards the modern toll road approach that had been initiated by Pennsylvania in the mid-1930s.⁴²⁵ At the time, general use toll roads still remained somewhat suspect, despite the fact that toll bridges were very common. Most toll roads at that time were recreational in nature and provided access to scenic areas like Pike's Peak, Great Falls, and Mt. Mitchell. Prior to 1930, the Long Island Expressway was the only toll road serving general motoring needs.⁴²⁶

Despite the fact that federal aid funds could not be applied towards the construction of toll roads, analysts still believed that a north-south toll route through the state could be a financial success. New Jersey met the conditions needed for a successful turnpike: a large amount of out-of-state traffic that did not contribute to revenues through vehicular fees, a small size that limited the amount of gasoline tax revenues generated by through traffic, and a property tax base that was insufficient to cover the extensive improvements required.⁴²⁷ A user-financed system addressed the need for an express route through the state without overburdening state taxpayers. The New Jersey Turnpike Authority was created in 1948 by the State Legislature. The first project undertaken by the Authority was a toll route connecting the George Washington Bridge with the Delaware Memorial Bridge. The contracts for the first phase of the project were let in 1949.⁴²⁸ The ultimate cost of the 118-mile New Jersey Turnpike was \$255 million.⁴²⁹ In the September 1954 issue of *Progressive Architecture*, the New Jersey Turnpike was described as "one of the earliest, and according to leading engineers, still the best expressway for mixed traffic."⁴³⁰

⁴²³Rae, *The Road and the Car in American Life*, 176.

⁴²⁴Sigvald Johannesson, *New Jersey State Highway Department Planning Bureau - A Comprehensive State Highway System*, 2.

⁴²⁵Harmer E. Davis, et. al., *Toll-Road Developments and Their Significance In Provision of Expressways*, 14.

⁴²⁶P. K. Schuyler, "Is the Toll Road a Solution?" *Roads and Streets* 70, no. 4 (April 1930), 130.

⁴²⁷Davis, et. al., *Toll-Road Developments and Their Significance In Provision of Expressways*, 1.

⁴²⁸Miller, "History of the Modern Highway in the United States," 118.

⁴²⁹Rollings, *Highway Facts U.S.A. 1952*, 77.

⁴³⁰"New Jersey Turnpike," *Progressive Architecture* 35, no. 9 (September 1954), 96.

Road Construction

By 1927, the number of cars on the nation's roads had risen to over four times pre-war levels. The number of trucks increased over seven-fold during this period.⁴³¹ Highway improvements during the 1920s generally focused on repairing war-damaged roads and improving the existing road network. Construction programs in the 1930s, however, made great strides in increasing the country's mileage through new construction programs. During the 1940s national highway mileage was double that of the 1920 system, and by 1945 the amount of improved roadway finally surpassed the amount of unimproved.⁴³² The amount of new construction reflected a strong growth rate in car ownership and traffic volume. In 1951, traffic was 51 percent greater than it had been ten years before.⁴³³

The rapid growth rate of traffic volume during this period convinced highway engineers that roads should be constructed with serious thought given to the possibility of future expansion. It was important not simply to increase mileage, but to improve the road system by constructing, where required, the best possible roadway. Roadway width, pavement strength, and capacity were all given serious consideration after World War I.⁴³⁴ Planners began to conceive of different types of highways, each of which had a unique role to play in the overall transportation system. By the 1930s, approaches to transportation planning had proceeded far beyond the 1910s goal of creating two-lane networks of roads to connect major towns. Engineers began plotting out arterial highways, belt highways, and radial highways.⁴³⁵

The 1939 World's Fair in New York City gave visitors a fantastic vision of the future of transportation. Designed by Norman Bel Geddes and sponsored by General Motors, "Futurama" depicted the city of the future, circa 1960, with seven-lane one-directional highways, four-level city streets, and roadways designed for 100 mile-per-hour speeds.⁴³⁶ Some of "Futurama's" predictions were not too far off the mark, but it took several more decades to begin to realize them. Meanwhile, the New Jersey Highway Department, long considered a leader in the field of highway design, sustained the state's progressive attitude by installing such new design features as: traffic circles, cloverleaves, divided highways,

⁴³¹Snow, ed., *The Highway and the Landscape*, 9.

⁴³²Rae, *The Road and Car in American Life*, 65.

⁴³³Rollings, *Highway Facts U.S.A. 1952*, 23.

⁴³⁴Wyatt B. Brummitt, "The Superhighway," 87.

⁴³⁵Rollings, *Highway Facts U.S.A. 1952*, 78, 81 and 87.

⁴³⁶"The Magic City of Progress," *The American City* 54 (July 1939), 40.

elevated and depressed roadways, and reflecting curbs.⁴³⁷ While perhaps not as visionary as Bel Geddes' model, these steps towards highway efficiency were still very forward-looking.

Without the assistance of road building machinery, advancements in highway design during the first half of the century would have been impossible. Prior to World War I, earth-moving machines, besides the horse-powered grader, were not widely used. The introduction of war-surplus caterpillar tractors in the 1920s changed the way highway engineers thought about grading. Motorized tractors moved large amounts of earth quickly and cheaply, enabling engineers to implement the "straight-line" approach to highway construction.⁴³⁸ The ultimate goal of creating the shortest route between two points could now be accomplished by simply moving the hills and valleys around until a level path was achieved. These "shotgun" and "beeline" roads were regularly constructed until the mid-1930s, when studies confirmed that the monotony of the design caused driver fatigue and resulted in higher accident rates.⁴³⁹ These routes also suffered from erosion problems because their alignments disregarded existing topography.⁴⁴⁰

Other mechanical developments introduced during this period included the large-scale cement mixer, the power shovel, and the pneumatic drill. Elevating graders and motorized rollers and scrapers replaced the laborious hand excavation of previous eras.⁴⁴¹ Eventually, the four-horse teams that had formerly powered most road working machinery gave way to gasoline-powered engines.⁴⁴² Hand-excavation did, however, make a brief comeback during the Depression, when the object was to make work for the most people.⁴⁴³

According to a 1926 issue of the industry journal *Roads and Streets*, "practically all of the roads that were surfaced (in the United States) in 1904 have since been resurfaced, and undoubtedly a considerable percentage of the 257,291 miles surfaced in 1914 has also been replaced with new, better, and wider surfaces since that date."⁴⁴⁴ By 1914, three-quarters

⁴³⁷Goldmann and Graves, *The Organization and Administration of the New Jersey State Highway Department*, 384.

⁴³⁸Snow, ed., *The Highway and the Landscape*, 4.

⁴³⁹Jac L. Gubbels, *American Highways and Roadsides* (Boston: Houghton Mifflin Company, 1938), 6.

⁴⁴⁰Snow, ed., *The Highway and the Landscape*, 5.

⁴⁴¹Upham, "The Last Two Decades in Highway Design, Construction, and Maintenance," 92.

⁴⁴²John W. Oliver, *History of American Technology* (New York: The Ronald Press Company, 1956), 568.

⁴⁴³Mark Rose, *Interstate: Express Highway Politics 1939-1989*, 17.

⁴⁴⁴MacDonald and Fairbank, "The Development of Improved Highways," *Roads and Streets* 66, 71.

of the country's rural roads were paved with a "higher-type surface" than untreated macadam.⁴⁴⁵ Paving has a limited life-span, especially in high-traffic areas, and improved paving materials often replaced those originally installed. In the road journals of the 1920s, there was considerable discussion about how to preserve existing pavements during road improvements, primarily to lower costs. In many cases, highway departments preserved original macadam pavements in place, while new sections of paving, often of concrete or brick, were added to either side in order to widen the roadway.⁴⁴⁶

The use of bituminous pavements was widespread during the 1910s. The affordability of this paving material made it a popular choice for medium-traffic areas. Traffic loads in the early 1920s, especially in North Jersey, increased to the point that concrete became the preferred pavement for the state's highways.⁴⁴⁷ Designers of the "ideal section," a segment of the Lincoln Highway located forty miles south of Chicago in Indiana, set the standard by promoting the use of a 40-foot wide, 10-inch thick, reinforced concrete roadway in 1923.⁴⁴⁸ Although concrete was more expensive per mile than other types of paving, its long term durability, as proven during wartime conditions, and its low maintenance costs made it good choice for high-traffic areas.

The invention of the paving train further improved the construction process by allowing large amounts of concrete to be poured continuously.⁴⁴⁹ During the 1920s, large slabs were individually laid with wide expansion joints between them. But by the 1950s, improvements in pouring mechanisms allowed continuous sections to be poured and later cut with diamond-blade saws, resulting in much narrower, and less-jarring, expansion joints. New Jersey not only adopted concrete as the state's standard pavement by the late 1920's, but also spent a great deal of energy studying its material properties and working to develop proper proportions for the mixtures. During the 1920s, it was common to use more than one type of concrete in a given section of road, and this often led to failures. The New Jersey Highway Department materials lab strove to standardize cement types, eliminate marked differences between them, and develop proper specifications for consistent mixes.⁴⁵⁰

⁴⁴⁵Ibid., 72.

⁴⁴⁶H. S. Perry, "Reconstructing Old Roads to Meet Present Day Traffic Requirements," *Good Roads* 71 (May 1928), 293.

⁴⁴⁷Andrews, "Modern Road Improvement Practice Sets High Standards," 48.

⁴⁴⁸Chatburn, *Highways and Highway Transportation*, 413.

⁴⁴⁹Hugill, "Good Roads and the Automobile in the United States 1880-1929," 342.

⁴⁵⁰Goldmann and Graves, *The Organization and Administration of the New Jersey State Highway Department*, 589.

It was difficult for highway departments to predict the amount of traffic that would develop after World War I. Few people could envision the day when even four-lane roads would be necessary. Consequently, the state was not preoccupied with road widening prior to the 1920s and gave little forethought to securing additional rights of way for future expansion.⁴⁵¹ When growing traffic congestion forced the department to expand these original rights-of-way in the 1940s, the cost was much higher due to increased development on surrounding property in the intervening years.

Procurement of right-of-ways during the 1940s was not determined by any set standard, but rather by an examination of projected traffic flow, type of terrain, and surrounding property values.⁴⁵² Property values significantly impacted the design of New Jersey's Garden State Parkway in the mid-1950s. At the southern end of the parkway, the rights-of-way are much larger, medians range up to 400 feet wide, and more landscaping was incorporated into the design, because land prices were low. At the northern end, high land costs limited the right-of-way width, and medians measure only 30 feet.⁴⁵³ In 1941, the most common right-of-way widths for New Jersey's highways were 66 feet (38%) and 80 feet (20.34%). Only 3.5 miles of roadway in the New Jersey state system measured 33-foot-wide or less, and 7.6 miles measured 250-foot-wide or more.⁴⁵⁴

Reasons other than projected expansion sometimes led to the purchase of wide rights-of-way. In some cases, it was more cost effective to include land with needed construction materials, like fill, within the right-of-way rather than transporting it from another site.⁴⁵⁵ In other instances states purchased wide rights-of-way with the intent of preserving scenic roadside features and limiting the installation of billboard advertising.⁴⁵⁶ By 1930, the federal government considered a 100-foot right-of-way the minimum necessary to provide sufficient space for expansion, utility lines, sidewalks, parking, and landscaping.⁴⁵⁷

⁴⁵¹Miller, "History of the Modern Highway in the United States," 104.

⁴⁵²Goldmann and Graves, *The Organization and Administration of the New Jersey State Highway Department*, 339.

⁴⁵³Snow, ed., *The Highway and the Landscape*, 114.

⁴⁵⁴Goldmann and Graves, *The Organization and Administration of the New Jersey State Highway Department*, 341.

⁴⁵⁵Gubbels, *American Highways and Roadsides*, 9.

⁴⁵⁶Snow, ed., *The Highway and the Landscape*, 120.

⁴⁵⁷Laurence Isley Hewes, *American Highway Practice*, vol. 1 (New York: John Wiley and Sons, Inc., 1942), 14.

Improvements involving the expansion of rights of way, often included alignment modifications. In the mid-1920s, engineers became interested in increasing the efficiency of automobile travel. In some instances roadways were actually relocated to create faster, safer routes, but most cases involved tailoring existing alignments.⁴⁵⁸ In his book on highway administration and finance, E. W. James noted that while proper alignments and grading should be developed for every roadway, "roadways should be built to the extent and of such types as will pay for themselves."⁴⁵⁹ The creation of a proper alignment was considered fundamental to all roads, but the choice of width and pavement type reflected levels of intended use.

After World War I, the cross section of the average road progressively increased from a width of fifteen feet of "metal," or surfacing, to a width of twenty-four feet with comparable increases in shoulder width.⁴⁶⁰ As engineers introduced new highway designs that addressed growing safety and congestion concerns, roadways continued to expand. On routes with heavy traffic, the paved two-lane road, the pinnacle of achievement before the war, gradually gave way to wider roadways with increased capacity. At first, an additional passing lane was added to a two-lane route. The three-lane arrangement, however, proved at best unsatisfactory and at worst fatal. Problems arose due to many drivers' tendency to drive down the center lane of the road, instead of using it to pass, a habit instilled during the days of high-crown roads.⁴⁶¹ Four-lane and even a limited number of five and six-lane, undivided roads were built in New Jersey during this period to address growing traffic levels.

The dualized four-lane highway emerged as the preferred alternative for high-traffic routes during the 1940s, because the use of a center island or median greatly increased safety. Gilmore C. Clark observed in his 1950 essay on highway design, that "it is now universally recognized that any four-lane facility should be constructed as a divided highway with as wide a median dividing strip as may be feasible."⁴⁶² When taken to its logical conclusion, this premise led to the dismissal of the fixed cross section and adoption of a policy of addressing dualized highways as two separate, one-directional roadways

⁴⁵⁸"The Economics of Relocation," *Good Roads* 71, no. 12 (December 1928), 647.

⁴⁵⁹E. W. James, *Highway Construction, Administration, and Finance* (Washington, DC: Highway Education Board, 1929), 120.

⁴⁶⁰L. I. Hewes, "Highway Engineering," *Highways in Our National Life: A Symposium* (Princeton, NJ: Princeton University Press, 1950), 329.

⁴⁶¹Snow, ed., *The Highway and the Landscape*, 12.

⁴⁶²Gilmore D. Clark, "The Design of Motorways," in *Highways in Our National Life: A Symposium* (Princeton, NJ: Princeton University Press, 1950), 300.

with independent profiles adapted to the existing terrain. Construction of expressways also led to the creation of cross-section elements that supplemented roadway travel lanes. The New Jersey Highway Department built speed lanes to accommodate entry and exit for express-routes and "creeper lanes" on some two-lane highways in hilly areas for use by slow moving traffic.⁴⁶³

It should be noted, however, that despite the innovative nature of highway design in this era, two-lane roads remained the standard. Even in 1942, mileage of two-lane, undivided highways was 2.25 times greater than the mileage of all other highway types combined: 1,130 miles to 503.5 miles respectively.⁴⁶⁴ The chronological development of innovations in highway cross-section designs is as follows: 1920 - two lane, undivided with an 18-foot width; 1930 - three-lane or four-lane roadways with an approximate 40-foot width; 1935 - introduction of four-lane, divided highways with a 60-foot width; 1940 - four-lane, divided highway with depressed median strip; 1945 - four-lane, divided highway with variable width median, separated roadways on different grades, and a width over 78 feet.⁴⁶⁵

Prior to World War I, road cross-sections had steep drainage ditches and elevated roadbeds. This design, when combined with narrow widths and increasing traffic, created dangerous driving conditions, especially since guardrails were uncommon. In the 1920s, highway department engineers recommended regrading ditches to create wider, shallower profiles, adding more guard rails, and replacing bridges and culverts that were narrower than the improved roadway widths.⁴⁶⁶

In the late 1920s and 1930s, the idea of working with existing topography rather than reconfiguring it through the use of earth movers began to take hold. Rather than completely re-engineering drainage patterns for a section of road, engineers recognized that it was more cost-effective, in the long run, "to take the natural drainage into account and to interfere with it as little as possible."⁴⁶⁷ Creating gentler slopes not only reduced erosion, but also facilitated roadside maintenance, like mowing, and provided longer sight-distances. An article in the January 1946 issue of *The American City* illustrates the widespread national acceptance of this policy stating, "No longer will there be the narrow

⁴⁶³Rollings, *Highway Facts U.S.A.* 1952, 80; New Jersey Highway Department Bureau of Public Information, *Development of the New Jersey State Highway System*, 32.

⁴⁶⁴Goldmann and Graves, *The Organization and Administration of the New Jersey State Highway Department*, 390.

⁴⁶⁵Snow, ed., *The Highway and the Landscape*, 13.

⁴⁶⁶Chatburn, *Highways and Highway Transportation*, 364.

⁴⁶⁷Gubbles, *American Highways and Roadsides*, 8.

dangerous shoulders on newly constructed highways; no longer steep ditches and barren, eroding slopes to stand as evidence of unsightly construction. In their places will be broad shoulders capable of supporting occasional traffic, wide gentle ditches, and slopes which are molded and blended with their natural surroundings."⁴⁶⁸

Heavy traffic loads during World War I, caused highway engineers to reconsider the nature of road construction. Roads were finally seen as designed structures, rather than simply as wearing surfaces. After World War II, similar levels of heavy-load traffic on major wartime transportation routes caused engineers to realize that highway systems were comprised not only of the actual roadway structure, but also of the character of the soil below the roadway in the sub-base.⁴⁶⁹ John Bateman's 1948 textbook of highway engineering states that at that date the highway structure embraced the entire right-of-way, the area between boundary lines with private property. Included within this area were the sub-grade, roadway, shoulders, roadside, drainage system, and miscellaneous structures like guard rails, sidewalks, retaining walls, lighting systems, grade-crossing treatments, and signs.⁴⁷⁰

Concerns for speed and safety fueled the movement to eliminate crossings at grade on highways. The New Jersey State Highway Department focused their efforts on removing railroad grade crossings during the 1920s; earlier than many other states.⁴⁷¹ Before their elimination, railroad grade crossings often caused long delays on congested roadways and presented a safety hazard for inattentive or unsafe drivers who disregarded warning signals as trains approached. The New Jersey State Legislature passed a law in 1929 requiring railroad companies to split the cost of grade crossing elimination with the state. The state issued an \$83 million bond the next year to assure adequate funding for the program.⁴⁷² Highway planners also surveyed routes for new road construction that paralleled existing railroad lines, rather than criss-crossing the tracks as pre-highway roads had done. This reduced the need for many expensive overpasses.

The expansion of the highway system in the 1940s led to a secondary initiative to eliminate grade crossings at intersecting highways. By 1942, the New Jersey Highway Department

⁴⁶⁸Nelson M. Wells, "Beautiful Highways for Urban and Rural Areas," *The American City* 61 (January 1946), 79.

⁴⁶⁹Poyntz Tyler, ed., *American Highways Today*, vol. 29, 166.

⁴⁷⁰Bateman, *Introduction to Highway Engineering*, 7.

⁴⁷¹Goldmann and Graves, *The Organization and Administration of the New Jersey State Highway Department*, 397 and 398.

⁴⁷²*Ibid.*, 398.

had constructed 192 of these crossings, which generally required the installation of an underpass or overpass.⁴⁷³ Other types of traffic control that were in use by 1950 varied according to the nature of traffic on the intersecting highways. Some intersections were regulated simply through the use of stop signs, others by policeman, and heavy-traffic intersections employed traffic signals. The American Association of State Highway Officials (AASHO) standardized the current red, yellow, green signal scheme in 1922.⁴⁷⁴ The railroad industry had established the precedent for that arrangement. The color red had always served as an effective indicator for "stop," but prior to the AASHO's meeting, some confusion remained concerning the meanings of yellow and green. By the late 1930s, transportation planners realized that in certain instances, old-fashioned, timed signals reduced efficiency rather than improving it. Efforts were then made to improve traffic-signal technology. Pressure-sensitive, traffic-activated signals were installed as early as 1936 and were complemented by pedestrian "walk" buttons mounted to signal posts.⁴⁷⁵ In the early 1940s, progressive signal systems were also developed that allowed traffic moving at a pre-determined rate to encounter only green lights.⁴⁷⁶

New Jersey was a leader in the use of overhead traffic signals to regulate patterns of bridge traffic. The 1940 travel lane arrangement on the five-lane Edison Bridge provides a good example of this practice. During slow times the center lane was restricted to use as a safety island, but during peak periods of traffic flow, three lanes were used in the direction of the most traffic.⁴⁷⁷ The electrical division of the highway department was responsible for monitoring and maintaining the system's signals. In 1941 there were 28 bridge signals and 124 traffic signals, as well as additional, outdated signals that had yet to be brought under highway department control.⁴⁷⁸

Complicated intersections often initially used reflector buttons and then, later, channelizing islands to direct traffic to the proper location.⁴⁷⁹ These islands, used in combination with sidewalks, also helped segregate pedestrian traffic from automobile traffic. Pedestrian safety became a major concern by the late 1920s, because 55 percent of traffic-related

⁴⁷³Ibid., 396.

⁴⁷⁴Chatburn, *Highways and Highway Transportation*, 446.

⁴⁷⁵"Traffic Control and Facilitation," *The American City* 51 (July 1936), 89.

⁴⁷⁶"Are Your Traffic Signals Modern?," *The American City* 56 (March 1941), 97.

⁴⁷⁷Goldmann and Graves, *The Organization and Administration of the New Jersey State Highway Department*, 546.

⁴⁷⁸Ibid., 544-545.

⁴⁷⁹"Channelizing Traffic Islands," *The American City* 51, no. 8 (August 1936), 43.

fatalities at that time involved pedestrians.⁴⁸⁰ According to an article in *The American City*, New Jersey was the only state in 1930 to have legislation in place authorizing the use of state highway funds to construct sidewalks along rural highways.⁴⁸¹ Advocates of pedestrian safety considered sidewalk installation very important, because at that time, people commonly walked along the highway. At night, this often proved fatal.

Overpasses effectively eliminated intersections, and traffic signals regulated them, but in other situations, continuous traffic-flow between routes was the intended goal. In those cases, highway departments utilized rotaries and other grade-crossing structures.⁴⁸² The nation's first rotary intersection was constructed in Camden, New Jersey. Camden's Airport Circle, as it was then called, was completed in 1925.⁴⁸³ Over seventy new traffic circles were added to the New Jersey Highway System during the following two decades. By 1942, however, engineers became disenchanted with the extensive use of rotaries claiming, "the rotary idea is a good one, but that does not mean rotaries should be constructed where other solutions may be just as economical and perhaps more efficient."⁴⁸⁴

The New Jersey Highway Department took another landmark step in 1928 with the construction of the country's first cloverleaf intersection. The original cloverleaf was located in Woodbridge, New Jersey at the junction of Routes 4 and 25.⁴⁸⁵ The highway department constructed two additional cloverleaf intersections prior to 1942, the Paramus Cloverleaf at the intersection of Routes 2 and 4 and the Mays Landing Cloverleaf at the intersection of Routes 42 and 50. Cloverleaf intersections were not as commonly used as rotaries, because they required more land, which consequently raised construction costs.

Between the two world wars, highway engineers significantly expanded their number of highway design options. Germany's autobahn system influenced large numbers of American engineers during the late-1920s and early-1930s. Many leading highway planners traveled to Germany and brought back novel ideas concerning traffic interchanges,

⁴⁸⁰"Traffic Accident Statistics: Findings and Recommendations of the Committee of the National Conference on Street and Highway Safety," *Roads and Streets* 70, no. 7 (July 1930), 264.

⁴⁸¹"Legislation is needed for Highway Sidewalks," *The American City* 43 (November 1930), 165.

⁴⁸²R. H. Baldock, "The Design of Highway Intersections," in *Highways in Our National Life: A Symposium* (Princeton, NJ: Princeton University Press, 1950), 309.

⁴⁸³Goldmann and Graves, *The Organization and Administration of the New Jersey State Highway Department*, 393.

⁴⁸⁴*Ibid.*

⁴⁸⁵*Ibid.*, 396.

local frontage roads, elevated and depressed highways, and median strips.⁴⁸⁶ No longer were engineers limited to improved two-lane roads; the alignment and cross-section of the roadway could be tailored to suit the particular needs of a given route. Elaborate construction programs, like parkways, were developed for large urban areas with lots of passenger traffic. Smaller towns with limited traffic merited construction programs that were scaled-down to match local needs.⁴⁸⁷

Transportation planners devoted a great deal of time to the concept of "superhighways" during the late 1920s. A superhighway was not a specific highway type, but rather a new transportation concept. Superhighways were routes that successfully expedited the existing transportation flow, thereby creating an express route. In some rural areas, a three-lane pavement with room for expansion could be considered a superhighway. Dense, urban areas, however, required that a superhighway be a dualized route complete with grade separations.⁴⁸⁸ According to Spencer Miller's paper "History of the Modern Highway in the United States," New Jersey took a leading role in the development of superhighway systems nationally. The multi-lane approach to the Holland Tunnel between Elizabeth and Jersey City is a good example of this type of design. This section of road is essentially limited-access and incorporates such characteristic features as: covered cuts, viaducts, grade separation, and controlled entrances and exits.⁴⁸⁹

William J. Vanderbilt helped charter the Long Island Expressway; the country's first expressway when it opened in 1908.⁴⁹⁰ The expressway concept did not catch on immediately. In 1923, however, designers of Westchester County, New York's Bronx River Parkway adopted aspects of the earlier design, while incorporating additional landscaping features into their route. A new highway type resulted-the parkway. Spencer Miller's essay on modern highway design defines a parkway as, "a limited-access highway, located through a park or along which highway there are publicly-owned strips of land of considerable width reserved for landscaping, picnic grounds, and other public recreation purposes....is ordinarily limited to passenger automobiles....trucks and other commercial vehicles are generally not permitted on the parkway although some special service roads paralleling it may be provided."⁴⁹¹

⁴⁸⁶Snow, ed., *The Highway and the Landscape*, 22.

⁴⁸⁷"The Objectives of Roadside Development," *Roads and Streets* 77, no. 4 (April 1934), 135.

⁴⁸⁸"The Superhighway," *The American City* 40, no. 1 (January 1929), 85.

⁴⁸⁹Miller, "History of the Modern Highway in the United States," 106.

⁴⁹⁰Hugill, "Good Roads and the Automobile in the United States 1880-1929," 327.

⁴⁹¹Miller, "History of Modern Highway Design in the United States," 108.

Civic leaders heavily endorsed parkways, which achieved great success due to their ability to facilitate commuter traffic flow, while preserving the value of nearby residential property. Westchester County officials appropriated additional funds by 1933 for the construction of an expanded county-wide parkway program including: the Hutchinson, Saw Mill, Briarcliff, Peekskill, and Cross County Parkways.⁴⁹² Connecticut followed with the creation of the Merritt Parkway, which was designed to relieve congestion on the Boston Post Road. Relief funds allocated during the Depression also contributed to the development of parkways within the National Parks. Construction of Colonial Parkway and Skyline Drive, both in Virginia, began in 1933.⁴⁹³ The New Jersey Highway Department lagged in the area of parkway development, even though the need for such express routes was pronounced. The state constructed its first, and thus far only, two parkways after World War II, the Garden State Parkway, begun in 1945, and the Palisades Inter-state Parkway, constructed between 1947 and 1957.⁴⁹⁴

Dualized highways evolved from the design of urban boulevards, which could be seen in such New Jersey cities as Trenton, Newark, and Plainfield during the 1920s.⁴⁹⁵ Dualization separated opposing traffic lanes using a wide median, which improved road safety. Two sub-types of dualized highways developed: expressways-divided, arterial, through highways, which have at least partial control over access; and freeways-through routes with full control of access.⁴⁹⁶ The construction of dualized highways in the United States did not occur until the late 1920s. Chicago proposed the first divided route in 1927, and New Jersey planned a similar route the same year.⁴⁹⁷

The State of New Jersey first targeted a section of the Brunswick Pike, Route 1, for dualization because of growing public outcry over the route's high accident rate.⁴⁹⁸ In order to lower expenses, engineers devised a way to push the original concrete roadway slabs apart using hydraulic jacks, which created a relatively narrow, central median strip between the slabs.⁴⁹⁹ Dualization became the standard for new construction on high-traffic

⁴⁹²Snow, ed., *The Highway and the Landscape*, 40.

⁴⁹³*Ibid.*, 41-42.

⁴⁹⁴*Ibid.*, 146.

⁴⁹⁵Miller, "History of the Modern Highway in the United States," 104.

⁴⁹⁶Rollings, *Highway Facts U.S.A. 1952*, 79.

⁴⁹⁷Miller, "History of the Modern Highway," 107.

⁴⁹⁸Goldmann and Graves, *The Organization and Administration of the New Jersey State Highway Department*, 390.

⁴⁹⁹Snow, ed., *The Highway and the Landscape*, 12.

routes. In 1932, the New Jersey Highway Department had eleven dualization projects under contract.⁵⁰⁰ Medians quickly proved to be more effective in preventing head-on collisions than earlier dividing features like painted lines or bumpy arrows embedded in the pavement that created vibrations when tires ran over them. By the mid-1930s central, raised barrier islands started to gain wide acceptance, and by 1940, one-fifth of the nation's 3,303 miles of four-lane and six-lane roads were dualized through the incorporation of a central barrier, island, or median strip.⁵⁰¹ The New Jersey State Highway Department developed central, concrete safety barriers in 1954. They installed these barriers, which have a distinctive tapered design, on 134 miles of the state's highways that year. These structures have now gained national recognition as "jersey barriers."⁵⁰² The widespread adoption of dualization during the 1930s also gave an added boost to the burgeoning interest in highway landscaping that was rekindled through the infusion of federal relief funds during the Depression. Wider rights-of-way and medians provided landscape architects more space in which to work. New Jersey and New York were among the first states to build dualized parkways with wide, park-like medians. New Jersey examples include the both the Garden State and the Palisades Interstate Parkways.⁵⁰³

Authorization of the interstate highway system in 1944 propelled the concept of limited-access highways to the top of every state highway department's agenda. All engineering professionals recognized by the 1930s that control over roadside access was crucial to the further development of the nation's highways. A limited access route is "a state highway especially designed for through traffic over which abutters have no easement of light, air, or access by reason of the fact that their property abuts on such way."⁵⁰⁴ Before New Jersey enacted enabling legislation in 1945, common law permitted property owners adjacent to a highway full, unlimited access to that roadway. This caused safety concerns as well as severe congestion problems, because local traffic and through traffic could not effectively be separated. Highway departments attempted to remedy the situation by working with municipalities to restrict commercial development to targeted areas through zoning, to limit subdivision development, and to create publicly-owned parkway strips along the roadways.⁵⁰⁵ These efforts proved ineffective; however, due to limited funds

⁵⁰⁰Goldmann and Graves, *The Organization and Administration of the New Jersey State Highway Department*, 391.

⁵⁰¹Norman Bel Geddes, *Magic Motorways*, 1st Printing (New York: Random House, 1940), 69.

⁵⁰²New Jersey State Highway Department Bureau of Public Information, *Development of the New Jersey State Highway System*, 29.

⁵⁰³Snow, ed., *The Highway and the Landscape*, 47.

⁵⁰⁴Goldmann and Graves, *The Organization and Administration of the New Jersey State Highway Department*, 347.

⁵⁰⁵*Ibid.*

and development pressure. The passage of New Jersey's enabling legislation endowed the state highway department with the right to "give preference to through traffic by providing access connecting with select public roads only and prohibiting crossings at grade or direct driveway connections."⁵⁰⁶ The act also permitted the state to authorize the development of a system of freeways and parkways and to acquire 300-foot rights-of-way with additional land for necessary grade separations and interchanges.⁵⁰⁷

While limited access was popular with highway departments, many members of the general public could not visualize the benefits of this new type of highway and resented the government's attempts to restrict their property rights.⁵⁰⁸ Other groups, like the National Committee for the Restriction of Outdoor Advertising, believed that "limited-access highways with no roadside development would be a contribution to the preservation of scenic beauty."⁵⁰⁹ As a result of this controversy, highway departments only employed the design on a limited basis until the mid-1940s. According to one contemporary source, "the limited-access device has been used sparingly, but is gaining increasing recognition as sound and indispensable in facilitating safer and more efficient travel. Its inherent superiority will inevitably establish it as the standard for future street and highway development."⁵¹⁰ The New Jersey Highway Department had developed plans for the Garden State Parkway, earlier known as Route 4, before the limited-access enabling legislation was even finalized. Construction on that route was undertaken immediately, and shortly thereafter plans for other freeways, including the Trenton Freeway, which incorporated portions of the Delaware and Raritan Canal, and the Route 100 Freeway, which later evolved into the New Jersey Turnpike, were begun.⁵¹¹ Other forms of limited access routes existed prior to the passage of this legislation. The control over access, however, was not achieved by legislated means, but through the physical design of the structure. Elevated and depressed highways, which gained popularity in densely-populated areas, restricted access by locating the roadway out of the reach of abutting property owners.⁵¹² The Pulaski Skyway is an example of this strategy.⁵¹³

⁵⁰⁶Rollings, *Highway Facts U.S.A. 1952*, 78.

⁵⁰⁷Snow, ed., *The Highway and the Landscape*, 16.

⁵⁰⁸Poyntz Tyler, ed., *American Highways Today*, vol. 29, 160.

⁵⁰⁹Daniel M. Bluestone, ed., "Roadside Blight and the Reform of Commercial Architecture," in *Roadside America: The Automobile in Design and Culture* (Ames, IA: Iowa University Press, 1990), 180.

⁵¹⁰David R. Levin, "Limited-Access Highways in Urban Areas," *The American City* 59 (February 1944), 81.

⁵¹¹Miller, "History of the Modern Highway in the United States," 115.

⁵¹²W. Russell Tylor, "Social Factors in Development of Regional Highways," *Roads and Streets* 76, no. 6 (June 1933), 221.

⁵¹³"New Jersey Plans Arterial Road from Holland Tunnel," *Engineering News-Record* 94, no. 18 (April 30, 1925), 731.

In the mid-1930s, the state of New Jersey launched an intensive highway safety campaign, because of the state's increasing accident rate. Nationally, the traffic-accident fatality rate increased by 94 percent between 1920 and 1929.⁵¹⁴ New Jersey state officials began making substantial allocations for safety improvements including safety education, increased safety lighting, better traffic signals, increased sign usage, highway dualization, elimination of grade crossings, use of traffic circles, and installation of reflecting curbs, guard rails, and line markings.⁵¹⁵

New Jersey engineers invented the reflecting curb in 1938.⁵¹⁶ The curb contained angled grooves that reflected light from the headlights, making drivers more aware of the edge of the road and center islands. Designers also continued to improve guard rails during this period. Wire cables mounted on wood and concrete posts, steel-plate railings (some with springs), and masonry railings, which due to their expense were only installed in special areas like parkways, gradually replaced earlier, dangerous wood board railings.⁵¹⁷ Painted road markings had been used during the 1910s and 1920s to direct traffic as well as define crosswalks, parking spaces, and restricted zones.⁵¹⁸ The dim-out conditions of World War II led to an improvement in this type of paint. In 1942, a Philadelphia inventor added tiny glass beads to pavement-marking paint, which gave it a reflective quality, thereby enhancing night-time visibility.⁵¹⁹

Improvements in highway lighting lagged behind street-lighting improvements during the 1920s and 1930s, because private groups and municipalities did not have the authority to install lights along these routes.⁵²⁰ State highway departments generally had the responsibility to erect lights, but in many cases legislative action was necessary to make funds for lighting projects available. Surveys indicated that only 400-500 miles of highways were "adequately lit" in 1923. The New Jersey Highway Commissioner established a fund in 1937 to help municipalities install proper safety lighting in potentially dangerous areas such as bridge approaches, viaducts, traffic circles, grade separations,

⁵¹⁴"Traffic Accident Statistics: Findings and Recommendations of the Committee of the National Conference on Street and Highway Safety," *Roads and Streets* 70, no. 7 (July 1930), 264.

⁵¹⁵Goldmann and Graves, *The Organization and Administration of the New Jersey State Highway System*, 537.

⁵¹⁶*Ibid.*, 391.

⁵¹⁷Bateman, *Introduction to Highway Engineering*, 127.

⁵¹⁸Chatburn, *Highways and Highway Transportation*, 444.

⁵¹⁹Robert Mitchell, "Traffic Paint that Shines at Night Makes Night Driving Easier and Safer," *The American City* 61 (July 1946), 119.

⁵²⁰Kate Bolton, "The Great Awakening of the Night," *Landscape* 23, no. 3 (1979), 47.

cloverleafs, and important intersections. In the next five years, the department helped install 4,297 individual lights at 266 locations in the highway system.⁵²¹ Most lights along rural roads used sodium vapor lamps, which cast a yellow light, as opposed to the white light from mercury vapor and tungsten filament lamps installed in urban areas.⁵²² Highway departments used overhead suspension installations, pole-mounted fixtures set in the medians of dualized roads, and ornamental lamp posts with underground conduits.⁵²³ Ornamental installations, which were often installed at prominent locations like bridges and traffic circles, were installed by the electrical division of the New Jersey Highway Department. The local utility company was responsible for lighting installations at other locations.⁵²⁴ Experiments with fluorescent lighting, which was found to be less-expensive and to cast a more even light than earlier lamps. The New Jersey Highway department first installed this type of lighting in 1939.⁵²⁵

In addition to the installation of safety features, the implementation of a consistent system of highway signs was another significant development during this period. Prior to 1925, no standards for the design or placement of road signs existed. Some routes, like the Lincoln Highway, had sponsoring groups that provided this service. Some sections of the country even had regional numbering systems, but not until the federal government designated the U.S. Routes, with their ubiquitous shield markers, was there a national standard for signs and route numbers.⁵²⁶ The 1925 legislation made life much easier for both travelers and map makers, because route names ceased changing from year to year, as they had done in the past. Individuals with an interest in roadside reform felt that signs should be simple and as small practicable.⁵²⁷ In their opinion signs, should not disrupt roadside views. However, others felt that signs should be as ornamental as possible. Signposts were made of wood, cast concrete, and steel. Cast iron plate signs noted the names of cities and the mileage to those destinations.⁵²⁸ In some cases, up to twelve separate signs were mounted on one post, which resulted in a great deal of motorist confusion. By the 1930s, the highway department replaced these types of signs with

⁵²¹Goldmann and Graves, *The Organization and Administration of the New Jersey State Highway Department*, 539.

⁵²²Bateman, *Introduction to Highway Engineering*, 129.

⁵²³Edward N. Hines, "Serving the Traveler by More Attractive Roads," *Engineering News-Record* 102, no. 1 (January 31, 1929), 33.

⁵²⁴Goldmann and Graves, *The Organization and Administration of the New Jersey State Highway Department*, 543.

⁵²⁵*Ibid.*, 547.

⁵²⁶Chatburn, *Highways and Highway Transportation*, 434.

⁵²⁷ *Ibid.*, 439

⁵²⁸New Jersey State Highway Department Bureau of Public Information, *Development of the New Jersey Highway System*, 28.

modern, pressed-metal signs mounted on simple wood or steel posts. The new signs had a simple format, larger letters, and less information than earlier signs. Reflector buttons mounted to the signs assisted night driving.⁵²⁹

Highway landscaping treatments became an important design consideration beginning in the 1930s. Prior to that time, the goal of the New Jersey Highway Department was to improve the greatest number of miles possible within their limited budget. The aesthetic aspects of highway design were overshadowed by issues of function and utility.⁵³⁰ Contributing factors that led to an increased interest in landscaping included the availability of federal funds for landscaping programs, growing right-of-way widths, and the widespread acceptance of highway dualization. In the first decades of the 1890s, roadside improvement groups at the local level often supported "beautification programs." They generally planted temperamental ornamental specimens that did not survive long beside the roadway. Eventually these programs were abandoned. In the 1920s, however, the California Highway Department revived interest in roadside beautification. Their approach encouraged the use of low-maintenance, native plants instead of ornamentals; a strategy that proved quite successful.⁵³¹

The American Association of State Highway Officials joined the Highway Research Board in 1932 to work with public groups like women's clubs, the American Legion, and the American Civic Association to promote "the aesthetic requirements and possibilities of highways."⁵³² At that date there were two general approaches to roadside plantings: the formal approach, in which trees were regularly spaced within a narrow right-of-way, and the informal approach, in which naturalistic plantings were positioned to frame distant views within wider rights-of-way.⁵³³ In addition to enhancing the motorist's driving experience, landscaping also prevented erosion and lowered maintenance costs. Jac Gubbels, a landscape architect working with the Texas Highway Department during the 1930s, noted that "Planting is, and should be, an insurance policy taken out on the stability and permanence of the roadside, and on the very foundation of the highway itself. It is to

⁵²⁹Goldmann and Graves, *The Organization and Administration of the New Jersey State Highway Department*, 461; Bateman, *Introduction to Highway Engineering*, 128.

⁵³⁰Sigvald Johannesson, *New Jersey State Highway Department Planning Bureau - A Comprehensive State Highway System*, 3.

⁵³¹Snow, ed., *The Highway and the Landscape*, 6-7.

⁵³²"The Objectives of Roadside Development," *Roads and Streets* 77, no. 4 (April 1934), 135.

⁵³³Bennett, "Roadside Beautification - A Glimpse into the Future: A Practical Plan for Development," 88.

the road what paint is to the house; it preserves and at the same time improves the appearance."⁵³⁴

Although landscaping began to gain recognition in the 1920s, it was generally a secondary consideration. Engineers did not incorporate plantings into their plans for the right-of-way and generally added landscaping as an ornamental gesture after completion of the roadway.⁵³⁵ In many instances, highway departments planted trees without much forethought and later had to prune them back severely when they began to interfere with utility lines. Gradually, as highway departments realized that they had to plan for future expansion, engineers were advised to create right-of-way cross-sections that coordinated landscaping, utility placement, sidewalks, and drainage with room for future roadway expansion.⁵³⁶ Highway departments began to treat landscaping seriously after 1933 when the Bureau of Public Roads declared that .5 percent and later 1 percent of federal aid funds must be spent on planting trees.⁵³⁷ The National Industrial Recovery Act also provided highway departments additional encouragement to establish a landscaping program, because a provision of the legislation made it a funding priority, "Especially impetus was given last year to roadside development by the Ruling of the Public Works Board under the Industrial Recovery Act. Six items of highway work are to have priority, and the second one named is appropriate landscaping on parkways or roadsides on a reasonably extensive mileage."⁵³⁸ Landscaping also received considerable attention during World War II, because defense experts worried about the repercussions bombing raids on the nation's highways might have on troop and supply movement. The military voiced a preference for the use of naturalistic plantings and gentle slopes that would allow vehicles to scatter off the roadway in the event of an attack. Highway camouflage became a design consideration during these years.⁵³⁹

In addition to their defense functions, some highway departments used planting configurations to direct driver behavior. In Arthur Bruce's 1950 textbook on highway design and construction, vegetation design is mentioned as a device that could "augment

⁵³⁴Gubbels, *American Highways and Roadsides*, 77.

⁵³⁵Arthur R. Nichols, "Landscape Design in Highway Development: A Coordinating Factor in the Layout of Traffic Ways," *Landscape Architecture* 30, no. 3 (April 1940), 115.

⁵³⁶Bennett, "Roadside Beautification," 88.

⁵³⁷"Roadside Planting," *Landscape Architecture* 26 (July 1936), 168.

⁵³⁸"The Objective of Roadside Development," *Roads and Streets* 77, no. 4 (April 1934), 135.

⁵³⁹Carl W. Wild, "Designing Highways For Peace and for Defense," *Landscape Architecture* 32, no. 4 (July 1942), 137.

safety precautionary needs."⁵⁴⁰ Bruce mentions that in some situations planting arrangements can be organized so as to "create a funnel or bottleneck effect on the highway for the psychological effect of reducing speed."⁵⁴¹ This type of landscape design was useful at intersection approaches.

The New Jersey Highway Department let its first contract for tree planting in 1926, and hired a part-time landscape architect between 1930 and 1933. That person's primary responsibilities dealt with such maintenance issues as mowing, tree trimming, and slope-seeding, rather than with the implementation of landscape designs on new roadways. The department hired a full-time landscape architect in 1937.⁵⁴² The John Davidson Rockefeller Memorial Parkway, a New Jersey Highway Department landscaping project, received national attention upon its completion in 1948. The project involved essentially recreating the existing Route 40 by removing commercial roadside enterprises and billboards, adding extensive sections of enhanced landscaping, and constructing several roadside parks.⁵⁴³ The program took ten years to complete, and the Works Progress Administration provided most of the funding for the improvements.⁵⁴⁴ The Garden State Parkway, completed in the following decade, is another notable example of highway landscaping in New Jersey. Landscape architects endeavored to make the highway merge with the landscape by carefully grading adjacent slopes, which allowed for safer emergency pull-offs and reduced mowing costs. The addition of low mounds covered with honeysuckle and fleecyvine in the center median also contributed towards the latter goal by reducing the amount of sod used. The landscape architects also tried very hard to plan their design around existing vegetation rather than remove existing features and replacing them with new ones. Only a few supplemental plantings were added where needed.⁵⁴⁵

Other features seen on designed motorways include a variety of motorist amenities. Comfort stations were considered essential, and highway departments constructed large numbers of them during the 1930s. These buildings generally provided sanitary toilet facilities and pure drinking water for motorists, and were located at regular intervals along

⁵⁴⁰Bruce and Clarkeson, *Highway Design and Construction*, 217.

⁵⁴¹*Ibid.*

⁵⁴²Goldmann and Graves, *The Organization and Administration of the New Jersey State Highway Department*, 467.

⁵⁴³*Ibid.*, 468.

⁵⁴⁴Oliver Deakin, "The Rockefeller Memorial Highway: A Notable Instance of Roadside Improvement in New Jersey," *Landscape Architecture* 38, no. 3 (April 1948), 96-97.

⁵⁴⁵Snow, ed., *The Highway and the Landscape*, 114-145.

highly-traveled routes.⁵⁴⁶ On certain scenic routes, like Oregon's Columbia River Parkway, great care was taken with their design, even down to the water fountains. The spring-fed fountains on Oregon's routes were equipped for drinking and also had basins for collecting water to fill radiators. The highway department's maintenance division individually designed each fountain.⁵⁴⁷

At scenic locations, picnic areas might also supplement a comfort station. These areas consisted of a small plot of ground, generally less than an acre, equipped with sturdy tables and benches of a rustic design and occasionally an outdoor fireplace or commemorative marker.⁵⁴⁸ On some highways, especially parkways, large roadside parks were developed. The highway department maintained these extensive parks, which were not formally designed like picnic areas and turnouts. In some instances these parks also included campgrounds.⁵⁴⁹ Turnouts provided safe areas where drivers could pull off the road for a short time. They rarely had amenities other than a drinking fountain and were minimally landscaped.⁵⁵⁰ Scenic overlooks were a specialized type of turnout that created a place where a motorist could pull over and take in a spectacular view of natural scenery. Landscaping often included rustic log guard rails, masonry retaining walls, and large boulders.⁵⁵¹ Other types of highway related structures include visitor information offices and highway department maintenance and administration buildings.

Conclusion

New Jersey's first colonists adopted existing trails used by Native-Americans as their first roadways. Among the most prominent of these early routes was the Bristol Road, which connected New York to Philadelphia by way of Elizabeth, New Brunswick, and Trenton, New Jersey. Very little money for regular road construction or maintenance was available during the eighteenth and nineteenth centuries. Federal appropriations for road construction were deemed unconstitutional in 1804, and the State of new Jersey raised only a paltry amount of money from state lotteries. A few military roads were constructed outside New Jersey during this era. Federal funds supported the creation of several routes

⁵⁴⁶Bennett, *Roadside Development*, 162.

⁵⁴⁷"Drinking Fountains Along Highways," *Roads and Streets* 70, no. 8 (August 1930), 277.

⁵⁴⁸Gubbels, *American Highways and Roadsides*, 56.

⁵⁴⁹*Ibid.*, 55.

⁵⁵⁰*Ibid.*, 57.

⁵⁵¹*Ibid.*

to the frontier, including the Cumberland Road. These types of roads were exceptional cases.⁵⁵²

The preferred mode of transportation until the mid-nineteenth century was by water, which proved to be considerably more efficient and reliable than travel over unimproved township roads. Most states had labor statutes in place throughout the 1800s. These laws compelled residents to pay a road tax or provide the equivalent in labor on the roads. As a result, farmers and other local residents with a limited cash flow generally built public roads at that time, because there was no funding to hire professional engineers or workers. Only a few days a year were devoted to road work. Consequently, township roads were often improperly graded and inadequately maintained. After the Revolutionary War, the number of vehicles on public roads rose substantially, causing further deterioration of the already poor existing conditions. Poor road conditions soon became a hindrance to economic development. Outlying farmers and manufacturers found themselves unable to make a profit, due to the fact that transportation costs for their goods often equaled production costs.

Eventually, private citizens stepped in to remedy the situation. Wealthy investors provided turnpike companies with capital for road construction, anticipating that toll revenues would repay their initial investment plus a share of the profits. New Jersey entered the turnpike era in 1800 with the incorporation of the Morris Turnpike, which linked New York City with settlements on the Upper Delaware River. As the decade progressed, additional turnpike companies established routes connecting New York with Philadelphia. A network of short turnpike routes also emerged uniting the hinterlands with ports where goods could then be shipped by water. The creation of passable routes that were designed with efficient hauling in mind helped reduce shipping costs and enhanced interregional communication. Stage coach lines established regular routes through the State at this time.

Canal and railroad development proved to be stiff competition for existing turnpikes as the century progressed. Toll roads struggled through the 1860s, fueled by the adoption of the plank road system of construction in the 1840s.⁵⁵³ This construction system created a much smoother road surface than earlier earth and gravel road beds. Unfortunately, the boards deteriorated more rapidly than anticipated, revenues for most routes did not meet expectations due to over-saturation of the market, and toll roads went into a steady decline.

⁵⁵²Holt, *The Bureau of Public Roads: Its History, Activities, and Organization*, 3.

⁵⁵³Seely, *Building the American Highway System*, 9.

Townships later took over administration of these toll roads, which then became free wagon roads. Most roads during this time period, however, served as feeder roads for railroads or other transportation systems.

Recreational pursuits, like cycling and open-air touring, initiated road reform during the last quarter of the nineteenth century, and gave way quite early to the more serious concerns of commuting, commerce, and military defense. With that shift in attitude, roads came to be considered an essential part of the country's transportation system, not merely a luxury. Highway transportation was a serious concern in New Jersey, from the inception the Good Roads Movement in the 1890s. The state became a national leader in road reform after developing the first state-aid legislation for road construction in 1891. State legislators sought to enhance New Jersey's role as a transportation conduit, attempting to draw upper-class residents and industrial development out of New York and Philadelphia and into the state's suburban environs. Quality roads made it easier for wealth to flow out from these metropolitan regions into New Jersey, as well as facilitating the shipment of locally manufactured goods and agricultural produce to these urban markets.

World War I had a tremendous impact on New Jersey's roads. The inability to coordinate rail shipments of military supplies around the Port of New York led to the adoption of the motor truck as a new option for transporting freight. After the conclusion of the war, New Jersey officials recognized the need to create a highway system of trunk-lines with high-type pavements capable of supporting heavier loads. The New Jersey Highway Department's materials laboratory made great strides in perfecting concrete roadways, which offered a vast improvement over unimproved macadam. Newly available federal aid funding and advancements in construction machinery made the creation of the state's 1917 highway system possible. Increasing traffic caused by the opening of the Holland Tunnel and the Delaware River Bridge, suburban growth, and tourist traffic to the state's shore and mountain resorts, led to a reevaluation of the system by State Highway Engineer William Sloan. This resulted in the creation of a comprehensive plan for a new highway system in 1927.

During the inter-war years development continued at an unprecedented pace, and the state's highway department engineers were challenged to create new designs that could relieve traffic congestion and enhance safety. The rotary intersection, cloverleaf, and reflecting curb all made their first national appearance in New Jersey, and the state also became a leader in superhighway design. Bypasses and limited-access routes took on additional

importance in the years leading up to the war. Extensive commercial development along the state's first highway routes became a significant impediment to their efficiency as transportation arteries. Local and through traffic had to be separated, and eventually routes like the Garden State Parkway and the New Jersey Turnpike accomplished this goal.

New Jersey roads evolved to meet increasing demands for efficiency, speed, and safety. By the mid-1940s, the country was poised on the threshold of a new transportation era. The car reigned supreme, and limited-access expressways, like interstate highways and toll roads, came to dominate the state's landscape in following decades. The automobile industry transformed the lowly dirt road and raised it up from its subservient position in the railroad era to one of undeniable prominence by the 1930s. Highways became a major economic force during the inter-war period, as opposed to the economic liability they had been in the previous century. Just as crossroads towns developed along unimproved roads in the nineteenth century, suburban developments and manufacturing centers quickly grew up around the exits of limited-access routes after World War II. These express routes created new towns and transformed existing ones, while leaving others to languish in the backwaters of county roads. In addition to their economic impact, highways also asserted a strong physical presence. Right-of-way widths continued to expand. Dualized four-lane highways took the place of two-lane gravel roads. Landscaping within medians and along boundary lines somewhat softened the visual impact. However, no matter what type of aesthetic treatment was applied, highways remained a potent force that continued to shape the land and the resources around them.

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